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NEWTON'S
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NEW SERIES.—No. XXXI.

MODERN INNOVATIONS OF SCIENCE AND THEIR RESULT.

The inequality in the physical condition of the rich and the poor has been a fruitful subject for comment to the moralist in all ages of the world. While, by the Jews, the extreme conditions were accepted as marks of Divine Providence attesting the merits and demerits of individuals—by the Greek philosophers and statesmen, the inequality was considered as an unmixed evil; and, acting according to their knowledge, they sought to render riches contemptible, and as difficult as possible to hold. They had seen that the accumulation of wealth was a sure precursor of the ruin of nations, and they judged that by its absence the vitality of their institutions would be secured. Later experience would seem to have confirmed this judgment; and England, owing to her growing commercial prosperity, has had her doom pronounced by those who see no difference between her present condition and that of Spain, when glorying in the possession of her newly-acquired gold-yielding colonies.

In England we are told luxury is daily becoming more rife, and nowhere can it be found that the son is content with the means which satisfied his father. The lesson we are left to draw from such premises is that the fate of the nation is sealed, and that every step made in applying science to the wants of mankind, is only hastening the inevitable result; because it serves to increase the means of indulging in luxurious habits. If this be a true statement of the case, what a fearful responsibility hangs over the heads of our experimental philosophers, who are the exponents of the hidden laws of matter, and of the practical chemists and mechanicians, who apply them to the uses of man! The case of the latter is indeed morally hopeless; for not only do they provide luxuries for the luxurious, but according to another, or perchance the same, set of reasoners, by the introduction of their novelties they take from the poor man the very means of his subsistence, and leave him at the mercy of those who are enjoying the benefits of the innovation from which he suffers. This fallacious belief that the labouring classes suffer materially from the advancement of applied science, is happily giving way to more reasonable views, which every-day experience only tends to extend and confirm. We shall therefore dismiss this item of obloquy, under which men of scientific pursuits have sufficiently long suffered, and consider what is the social tendency—not on classes, but on individuals in

the aggregate—of the modern innovations of science. This is a large and interesting subject; but we must content ourselves with a sketch, leaving our readers to fill up the outline from their own knowledge.

At the outset, it should be remarked, that luxury, which is so much dreaded by the stern moralist, is but a relative term: that is, it has a special and peculiar meaning to the person who uses it, and one that is not necessarily shared in by his auditors. Thus, for example, in the story which we are accustomed to hear of the hardy Scottish chieftain, who, in contempt of his son's habits of indulgence when on a campaign, kicked from under his head the snow bolster which he had just made to improve his *al fresco* couch, we have an interpretation of the word luxury, in which few at the present day will be found to acquiesce. The fact is, that this term has, in great measure, derived its meaning from the writings of the poets of the Daphne and Phillis school, who feign that virtue and hardihood are ever associated with the frugal simplicity of life followed on the hill-tops and in the valleys, while effeminacy and vice flourish among the comforts and delights of the city. It is difficult to contend against such broad propositions, because they contain a large amount of abstract truth; but thence, to conclude that a primitive life is the one most to be desired for large communities, is an error that needs to be carefully guarded against. Let us take, as a test of the effect upon the people of a modern innovation, one which has now become universal in its use, but which, at no great distance of time past, was, although in a very primitive and uninviting state, condemned as a luxury: we allude to travelling in carriages. We have it, on the authority of Beckmann, the well-known author of that curious book, "A History of Inventions, Discoveries, and Origins," that an ordinance is still preserved of Phillip the Fair, issued in 1294, for suppressing luxury, and in which the citizens' wives are forbid to use carriages. And to shew that it was not merely to maintain a class distinction, that objection was taken by the ruling powers to this kind of convenience, we may quote an order, which Beckmann notices, published by Duke Julius of Brunswick, in the year 1588, wherein he says, "that our vassals, servants, and kinsmen, without distinction, young and old, have dared to give themselves up to indolence and to riding in coaches;" and having condemned the practice as antagonistic to the cultivation of "the ancient Brunswick mode of riding, handed down and bequeathed to us by our forefathers," he commands that, "when they visit our Court, they shall not travel or appear in coaches, but on their riding horses." At Amsterdam, so little were coaches considered necessary, that the same authority tells us that "coaches with wheels were, so lately as the year 1663, forbidden, in order to save the expensive pavement of the streets." It is doubtful whether coaches in those days were, in point of comfort, equal to a spring van of modern times; yet was their use deemed too great a luxury to be

permitted without rebuke. A twenty-four hours' run in winter, from London to Manchester, on a mail-coach roof—the thought of which even now is calculated to make one who has experienced the treat shiver—would, no doubt, have been considered a luxury also. But what has really been the effect of increased convenience in travelling? Simply this, that those who would never have stirred from home but for the introduction of modern facilities, now move abroad, and get their faculties brightened, and their health preserved by change of scene; and those whose energy enabled them to brave the discomforts of stage-coaches, now extend the range of their journeys, or repeat them more frequently. Instead, moreover, of arriving at their destination benumbed with cold, and stiff in limb, by reason of the cramped position they were forced to retain during their journey, they now alight fresh and ready for business, having enjoyed, in a well-appointed carriage, freedom of limb, and perchance the comfort of a heated footstool, by means of which a proper circulation of the blood at the extremities was maintained. If the removal of discomforts be a luxury inimical to the growth and maintenance of a hardy people, then must the modern style of travelling be condemned; but we neither perceive a falling off of energy in the nation, nor do we acknowledge that an escape from discomforts implies self-indulgence.

In modern Europe, experiments have been carried on, for centuries past, to render the human constitution superior to minor disadvantages, but apparently without success; and the luxurious appointments in the dwellings of the ancient Romans have now begun to receive general adoption. Thus, for example, all the large cities of Europe were built on the ascetic principle of excluding air and light; and as for drainage and public means for removing offensive matter, even to this day such indulgences are by no means general. Under such advantages for disciplining the frame, poor humanity would thrive tolerably for a time, and then suddenly would arise a pestilence, from no apparent cause, and sweep off half the inhabitants of a city. Thus, in spite of all the seasoning, Nature would remain true to herself, and, in the end, assert her supremacy over human obstinacy. Modern philosophers have shewn the folly of thus excluding from our towns the breath of heaven and the sun's light; and slowly has the hand of innovation wrought a healthful change in our large cities. Water, too, another bountiful provision of nature, is being more liberally supplied and extensively employed; and it is anticipated that ere long, baths will be as general amongst us as the tesselated remains of our old Roman conquerors prove they were with them some eighteen hundred years ago. It is true that airy dwellings, well-drained streets, public baths, washhouses for the poor, and hospitals for the sick, all tend to soften the asperities of

life, and so far they are luxuries, as compared with what the people had formerly to endure. But at least we have arrived at this result, that as the need to endure such privations as were formerly common to all has ceased, so has the duration of human life increased. The statistical tables of the Registrar-General, which demonstrate the truth of this assertion, thus speak in terms that cannot be misunderstood, of the blessing to mankind of applied science, and of the miserable folly of those who attempt to bend nature to their own wills.

The experiences of the late war afford us lamentable examples of the existence of this perversity in high quarters, and of the utter impracticability of increasing the hardiness of the soldier by exposing him to excessive fatigue, spare living, and cold; but it is far too difficult a lesson to be mastered quickly by the masses. It must insinuate itself gradually into dull minds before it is received as a truth. The tendency of modern civilisation being to put a high value upon human life, it has been argued that courage must, under such an influence, decline: it wanted, perhaps, the evidence of the last war to shew how utterly valueless was such a deduction. Nevertheless it is still maintained that constant exposure to danger is essential to the training of a good sailor; and there are those who lament the introduction of steam into the mercantile navy, because, by facilitating navigation, it releases the seaman from much arduous labour. This is but a phase of the old argument against coaches, and doubtless it obtains through all the duties of the seaman's profession. Thus it must be very wholesome discipline to the jolly tar to be thrown occasionally, in a rough sea, over his steering wheel; any modification, therefore, of machinery which could give him a perfect command of the rudder, would be decidedly obnoxious to the advocates for severe training. Besides the admirable arrangements lately introduced for keeping the rudder to its work, we notice several valuable suggestions in the lists of recent patents for furling sails from the deck. As the introduction of these into the navy, by enabling the topsails to be reefed at a moment's warning, might greatly increase the safety of ships when caught by a gale of wind, and prevent many a sailor from being thrown from the rigging into the sea, they must soften the asperities of a seafaring life, and make milksops of tars. We are, however, willing to risk the chance; for it has yet to be proved, that he who courts danger is the true hero; and it is demonstrable, that not he who puts his head in the lion's mouth is the wiser man, but he who keeps his out. The living, too, of the sailor on board ship, has of late undergone considerable amelioration; for formerly there was little choice, in point of hardness, between his meat and his dry biscuit; but now, with the aid of modern improvements in the preservation of both animal and vegetable food, he fares very much

the same afloat as on shore; and scurvy, which was formerly a fearful pest to sailors, is now well-nigh banished from our fleets.

The world is little accustomed to commiserate the lot of the agricultural labourer, except on the score of his miserable pay; but there are seasons at which he is called upon to endure great bodily exertion, and that of a nature which is by no means beneficial to his constitution. Thus, the times of mowing, hay-making, and stacking hay, of reaping corn, and other cereals, and of threshing out the grain, require no ordinary amount of exertion; and as most of these operations are necessarily effected under the heat of a summer sun, the labour is very trying to the human economy. Here, again, has applied science stepped in, to smooth the lot of the agriculturist, and he has gained wisdom enough to appreciate the benefit. The introduction of threshing-machines, which in his eyes was so great an injustice as to justify the crime of rick-burning, is now not merely acquiesced in, but the act of threshing is now voted by the labourer as "horse's work," and not fit for men. For various reasons, mowing and reaping-machines are but slowly making their way in this country, but hay-making machines have come into general use; and so far as field labour, under a burning sun, has been superseded, or greatly mitigated, by the introduction of mechanism, we see no evidence of loss of stamina in the labourer, but a considerable addition to his mental powers. The almost universal employment of horse-hoes affords another instance of the amelioration of the condition of the husbandman, without a drawback; and, indeed, we should not even fear his degenerating into effeminate habits, if he were housed as comfortably as the cattle in our model farms.

The evident tendency of practical science is, as we maintain, to equalize the physical condition of man, and to lengthen the lives of those who are now exposed to excessive hardships. It cannot be denied that the human constitution may be strengthened by a judicious process of seasoning; but it is as certain that the frame, when taxed beyond its powers of endurance, whatever they may be, immediately begins to deteriorate. Historians tell us that men are at the present day capable of enduring more than in the earlier ages; and this they gather by comparing the forced marches of ancient and modern times, and the periods of inaction of contending armies, occasioned by the inclement seasons. If this be a true deduction from incontrovertible facts, it offers much encouragement to the moral philosopher; who, instead of indulging in Utopian dreams, like many of the Greek sages, has here presented to him a sure basis whence he may advance the work of ameliorating the condition of his species, physically as well as morally; for the latter cannot progress until the asperities of the physical life are in some degree removed; as stone will not take a polish until its surface is made smooth. Let

the philosopher then, and all who desire the good of mankind, accept, at least with willingness, increased mechanical facilities for accomplishing necessary duties, if they do not create them, and new lights in science which may serve to mitigate the ills of life, if they do not themselves discover them. Man, if rightly viewed, in his physical aspects, must be considered as an engine, capable of yielding up a given force, and no more, and to a degree only adaptable to varying circumstances or conditions. Extremes of any kind, whether of cold or heat, abstinence or feeding, are unquestionably injurious to his constitution, and must ever be so: it is perfectly useless to put him through discipline of this kind; for unnecessary exposure will only weaken the strong man, and render him less apt to endure when occasion shall require. To sum up then our case:—we consider the tendency of the modern innovations of science to be the amelioration of the physical condition of all, and especially of the laboring classes, which is an essential preparatory step to their moral elevation; and, as respects the inducement offered by modern appliances to self-indulgence, we consider, that so long as the mind of the people is kept in activity, which it must ever be so long as it is held in contact with new facts and circumstances, arising out of fresh advances made in physical science, no mere forbearance from needless toil or exposure will deteriorate those qualities of energy, enterprise, and endurance, for which the English character has long been conspicuous.

RECENT PATENTS.

To Duncan Bruce, *of Paspebiac, Canada, for making a concentrated animal manure.*—[Dated 30th September, 1856.]

This invention refers to the preparation of nitrogenous manures from animal matters, and has for its object so to fix the ammoniacal and other gases that they may be ready to act at once upon the crop without the necessity of waiting for the decomposition of the ammoniacal compounds, as is the case where they exist in the state of sulphates.

In soils abounding in carbonate of lime, sulphate of ammonia is readily decomposed, and given to the plants in the form of carbonate, as required; but there are many soils so deficient in lime as to be incapable of effecting this decomposition, and upon such soils those manures which owe their efficiency to the presence of sulphate of ammonia produce comparatively little effect, while the sulphate of ammonia, being readily soluble, is carried off by filtration, or is otherwise lost. To remedy this evil, and to produce a manure that shall always be ready for use upon any character of soil, is the object of the present invention; the first part of which consists in the employment, in connection with the animal matters, of a compound of carbonaceous and earthy substances, so united, by means of roasting the two in connection with each other, that the carbon shall be disseminated

through the whole body of the clay or other substance employed; by which means a complete absorbent of the ammoniacal and other gases, and a powerful disinfectant of the animal matters, is obtained. Various substances may be employed in the preparation of this carbonaceous absorbent; that which is preferred, however, is a species of bituminous shale, found at Port Daniel, near the mouth of the St. Lawrence River, as this mineral contains the carbon and the requisite earthy matter already most intimately united, and requires only to be roasted and ground to fit it for use. Where this substance is employed, it is subjected to a sufficient degree of heat in a crucible or closed retort, to carbonize the bituminous matter, and is then finely pulverized. This forms a powder, which, when employed as hereafter to be explained, acts as a powerful disinfector of putrescent animal matters, and as an absorbent of the gases which result from their decomposition. Where the bituminous shale cannot readily be procured, its place may be supplied by a factitious disinfector, having all or nearly all the properties of that made from the shale, produced by mixing certain carbonaceous matters with clay and other earthy substances, the materials being first pulverized and intimately mixed and then roasted, the latter operation driving the carbon entirely through the body of the clay or other earthy substances, and producing an intimate mechanical union of the two. As a source of carbon, the following substances may be employed:—Finely-pulverized bituminous or anthracite coal, sawdust, peat in powder, or other suitable finely-divided carbonaceous matter. As a base through which to disseminate the carbon, clay of the purest and best quality that may be procured, is employed; with this is incorporated about an equal quantity by weight of any of the before-mentioned carbonaceous substances: when these are not at hand, the cheaper forms of tar, either mineral or vegetable, may be employed. These substances are to be intimately incorporated with the clay, and the mixture is then subjected to a sufficient degree of heat in a closed crucible, retort, or kiln, to char the carbonaceous matter, and driven equally through the whole body of the clay; the latter becoming completely permeated with the carbon through the whole mass. Care should be taken that the heat be not sufficiently intense to vitrify the clay, or to heat it beyond the point which shall develope its absorbent qualities. When sawdust or peat is employed, the retort should be allowed to cool before it is opened, otherwise the mixture may take fire, and the object to be gained be defeated.

The clay, thus roasted, has now become very porous and saturated with the carbon as above stated, and in this state is found to possess great powers for the absorption of ammoniacal and other gases, and as a disinfectant of fecal and other putrescent animal matters. Other articles may, however, be employed, as coal ashes, garden mould; and soils more or less argillaceous, may be made to replace the clay, though the latter is the article preferred where the bituminous shale is not to be had.

The second part of the invention has reference to the preparation of the animal matters for the reception of the above-described powder. When boiling is resorted to for the purpose of reducing animal matters, it is found impossible, unless they are subjected to the action of strong alkalies, or to a high pressure of steam within a closed boiler, to reduce them to a uniform pulpy mass; and if this be not effected, the pieces and grains of undissolved animal matter will subsequently be attacked by worms and destroyed. To accomplish this solution of the animal matters, and to reduce it to a

pulpy liquid state, is the object of this part of the invention, which consists in subjecting them in vats to a temperature just sufficient to induce the degree of fermentation necessary to destroy their texture and reduce them to a watery mass,—the vats being kept closely covered, to prevent the loss of the gases generated by the decomposition. At this point of decomposition animal matters are found to act most rapidly and economically upon the growing crops; and the subsequent steps of the process have for their object only to arrest the decomposition at this point, and to fix and desiccate the juice and gases without altering their chemical state, and without loss or diminution.

The animal substances, whether they be fish, or offal of slaughter-houses, and whether they have been steamed or otherwise submitted to heat for the extraction of the oil or grease, or not, are thrown into vats of sufficient size to contain the accumulation of one day; these vats are then covered to exclude the air, and the contents are warmed from 90° to 120° Fahrenheit: where the temperature of the atmosphere is sufficient to effect this artificial heat need not be resorted to.

In the course of one to three days, according to the nature of the material employed, the fibres will be completely broken down, and the whole will become a semi-liquid pulpy mass: even the stomachs of the fishes, and the cartilaginous and other refractory portions of the animal refuse, will be entirely disorganized and reduced to a pulp. The prepared powder of shale or carburetted clay is now to be added to it, by sifting it regularly over the whole surface in the proportion of about one pound of the powder to three pounds of the original matter employed, or thereabouts; the mass being frequently stirred the while. The mixture is now to be evaporated, either by artificial means or otherwise; and should any lumps occur, they should be ground or crushed. When fish is used, as soon as the bone is separated from the flesh it should be removed, dried, finely ground, and returned to the mixture: this ground bone should be returned immediately after the prepared powder is added to the fish. When slaughter-house offal is employed, about thirty per cent. of ground bone may be added. When clear blood is used, the powder should be mixed with it while it is yet fresh: the mixture is then kept at the required temperature for a period of forty-eight hours, or thereabouts, when the powder will have become so intimately incorporated with the blood that the mixture may be evaporated. When night-soil is employed, it is placed in the vats and the prepared powder is sifted into it: the solid portions of the night-soil unite with the carburetted clay, and the superabundant liquid is evaporated, as before. In manures thus prepared, the gases resulting from the decomposition of the animal matter are mechanically united with the absorbent, without being chemically changed: they are in consequence ready to act immediately upon the plants without requiring the presence of any substance to effect their decomposition.

The patentee claims, "the within-described combination of carbonaceous and earthy matters, prepared by means of roasting and grinding in the manner set forth, for the purpose specified. Second,—the within-described manner of disorganizing the animal matters, by treating them in closed vats at the required temperature in combination with the method of disinfecting the same, and absorbing and fixing the ammoniacal gases by means of the above-described carbonaceous powder, operating in the manner substantially as set forth."

To JOHN JONES *and* ALEXANDER CUNNINGHAM SHIRREFF, *both of Glasgow, for improvements in the construction and application of rotatory motive-power engines and pumps.*—[Dated 22nd March, 1856.]

THIS invention relates to the arrangement and construction of rotatory motive-power engines capable of being worked by steam or other fluid pressure, and to the application of the same to cranes, and other lifting, lowering, and transporting apparatus.

In Plate I., fig. 1., is a longitudinal, and fig. 2, a transverse vertical section of a rotary engine, constructed according to this invention. *a*, is the steam cylinder, disposed horizontally, and cast with flanges, by which it is bolted down to a cast-iron base-plate *b*. The steam enters by a passage *c*, formed so as to enter the cylindrical chamber at one side thereof, whilst a similar passage *d*, on the other side, serves for the egress of the steam. These two passages *c*, and *d*, pass to a face in the valve-casing *e*, and a slide-valve *f*, serves to alter the direction of the current of steam, so as to reverse the engine. Inside the cylinder *a*, and working in contact with the upper side of the cylinder, is a smaller cylinder *g*, by preference of about four-fifths of the diameter of the cylinder *a*. This cylinder forms the revolving piece, and is in one piece with the shaft *h*, the two ends of which pass out through stuffing-boxes in the end covers *i*, of the cylinder *a*, and are supported in external bearings *j*. The rotating piece *g*, is hollow to the extent of about half its diameter, and is formed with three slots parallel to its axis, and directed radially towards its centres: in these slots are placed three pistons *k*, which are fitted with spring pressed plates or loose pieces, so as to work steam-tight into and out of the slots, and against the internal surface of the cylinder *a*. A roller *l*, placed in the central hollow of the rotating piece *g*, lies between the inner ends of the pistons *k*. The rotating piece *g*, is kept in steam-tight contact with the top of the cylinder *a*, by loose pieces *m*, which are adjusted by means of wedges *n*. The piece *g*, is thus excentric to the cylinder *a*, and a space of crescent form, in transverse section, is left between the two. The steam acts upon the area of the pistons exposed in this crescent-shaped space, and as each piston comes round to the narrow part of the crescent, the side of the cylinder forces it into its slot, until at *m*, it is wholly withdrawn within the piece *g*. This inward movement of each piston as it comes round, constantly maintains the roller *l*, in a position concentric with the cylinder *a*; and as the pistons again pass the point *m*, they are forced outwards by the roller *l*. The ends or shoulders of the piece *g*, and the ends of the pistons *k*, are kept steam-tight by means of a plate or lining piece *o*, inside one of the cylinder end covers *i*. This plate is pressed against the rotating piece and pistons by means of springs in the end cover, which springs can be adjusted by means of screws *p*, tapped through the cover. This adjustable plate may be applied at both ends of the cylinder, but this is not always necessary, as if the end furthest from the adjustable plate is slack, the pressing in of the plate will force the piece *g*, over to the other end, and so make it tight.

The figures represent the apparatus as constructed to serve as a steam-engine; but it may be adapted to act as a pump, or as a motive-power machine, worked by other fluids besides steam; the valve and other details, if necessary, being modified to suit the particular purpose to which the apparatus may be applied.

The improved rotatory engine may be applied to cranes and various kinds of lifting and lowering apparatus; and the invention also comprehends the application of a rotatory engine, of any suitable kind, to a crane, winch, or other raising or lowering machine: in other words, the invention comprehends the combination, in a single independent machine, of a crane, winch, or other raising or lower apparatus, and a rotatory engine of any suitable kind for working such crane, winch, or other raising or lowering apparatus.

The patentees claim, "First,—the application and use of rotatory motive-power engines or pumps wherein a hollow cylinder, forming part of or fast upon the main shaft, revolves excentrically within a cylindrical chamber, and is formed with slots in which pistons move in and out; such pistons being kept constantly against the sides of the cylindrical chamber by means of a central roller; the various parts being shaped and arranged substantially as hereinbefore described. Second,—the combination, in a single independent machine, of a crane, winch, or other raising and lowering apparatus, and a rotatory engine of any suitable kind, as hereinbefore described."

To JOHN BROOKE, *of Jewin-street, City, for improvements in lift-pumps.*—[Dated 8th April, 1856.]

THIS invention has for its object improvements in lift-pumps, for which purpose the bucket is composed of two metal cones, one fitting into the other, in such manner as to hold the cup leather or flexible material between them, there being a central passage or opening through each of the cones, which is covered by a valve, similar to what has heretofore been used when buckets of wood have been employed. The two metal cones are fixed together by means of a fork or prongs at the lower end of the pump-rod, which pass through the two cones and draw them together by screws and nuts at the lower ends of the prongs, by which means the passage through the bucket is undivided. The lower part of the pump barrel is made with an internal shoulder, to act as a seat for the lower or sucker-valve, the stem of which is made with three wings. Above the seat the diameter of the pump barrel is enlarged, in order to get a free flow of water around the valve, which is provided with a ring of vulcanized india-rubber, or other suitable flexible substance, where it rests on the shoulder or seat.

The figure in Plate I., shews, in section, a pump barrel with the bucket fitted thereto, and constructed according to this invention. *a*, is the internal hollow cone, which has the valve fixed to it; *b*, is the lower hollow cone, into which the cone *a*, is forced, and fixed in such manner as to hold the leather *c*, between them; *d*, is the pump-rod, which is forked, or has two branches d^1, formed on its lower end, by which and the screw-nuts *e*, or, it might be, keys or cotters, the two cones *a*, and *b*, together with the leather between them, are fixed and retained in each other. The pump barrel has an enlargement at *f*, and a shoulder or seating *g*, for a valve *h*, the stem of which is formed with three wings, as shewn.

To Alfred Vincent Newton, *of Chancery-lane, for an improved construction of rotary pump,—being a communication.*—[Dated 8th May, 1856.]

This invention of an improved construction of rotary pump consists in the combination of an angular arm or bucket, so made as to press the water outward from the shaft, with a spiral partition or partitions in the suction pipe, for giving the water an initiatory rotation in the direction contrary to that in which the arms or buckets revolve; also in the arrangement of parts, hereinafter described, by which the water is discharged around a partition in the chamber of the pump.

In Plate I., fig. 1, is a sectional elevation, taken through the middle of the improved pump; fig. 2, is a detached view of the partition which divides the chamber of the pump, and shewing also the form of the buckets; and fig. 3, shews the spiral in the suction-pipe. *a*, is the suction-pipe, the sides of which are curved outward at the inner end, to facilitate the entrance to the water. It is fitted with a three-winged spiral partition *b*, which gives the water, as it enters the chamber *c*, a rotary motion. This spiral is stationary, being securely attached to the suction-pipe, with tap-bolts or some other substantial device. The twist of this spiral is easy, the twist gradually increasing from the point where the edges of the spiral meet the water, to an angle of about thirty degrees to the axis of the spiral. The arms or buckets *d*, are attached to the pump-shaft *e*, to which motion is communicated by power applied to the pulley *f*. The arms *d*, revolve in the opposite direction to that in which the water revolves as it enters the chamber *c*, and are curved or scrolled, so as to present a constant angle of about forty-five degrees to a radial line drawn through any point of its working length, the angle being measured at the point of intersection. The face of each of these buckets is parallel to the shaft at the inner end, but at the outer end the edge nearest the suction-pipe is thrown forward, so far as to present an angle of about forty-five degrees to a line drawn parallel to the shaft, which angle gradually diminishes towards the inner end of the buckets. *i*, is a plate, cast in one piece with the arms *d*, and dividing the chamber *c*, into two parts: it leaves, however, an opening around the periphery for the water to pass. This permits of the water being discharged at the centre or periphery of the chamber, with equal facility, and promotes and facilitates the discharge, by allowing the water to pass out from the buckets all around the periphery, instead of requiring it to be carried to a particular point in the circuit. It also strengthens the arms and counteracts the pressure of the shaft upon the footstep *l*, and the collar *m*, caused by the twist or curve of the buckets. The water passes around the edge of the plate *i*, into that division of the chamber which is farthest from the suction-pipe, and is discharged through the discharge-pipe *j*. The shaft is kept from being drawn towards the suction-pipe, by the adjusting footstep screw *l*, and the collar *m*. *n*, is the bed-plate to which the pump is bolted; and *o*, is a bracket to support the end of the shaft.

The patentee claims, "the combination of the arms *d*, constructed in any equivalent manner, with the spiral partition *b*; and also, dividing the chamber *c*, and reducing the pressure upon the footstep by the plate *i*, or its equivalent, substantially as herein set forth."

To Joseph Henry George Wells, *of Essex-street, Strand, for improvements in pistons for steam and other motive-power engines and pumps in general, and which improvements are also applicable to stuffing-boxes,—being a communication.*—[Dated 8th July, 1856.]

This invention consists in making the piston of cast-iron, and of one piece, and surrounding it by a ring made of hemp or other elastic material; also, in allowing the pressure of the steam, gas, or liquid to act upon the said ring and press it against the cylinder, thereby preventing any communication above or below the piston; and also, in allowing the pressure of the steam, gas, or liquid to act in a similar manner upon the like packing or ring, placed around the piston or other rod, to render the same air-tight.

The figure in Plate I., is a section of a piston and stuffing-box, applied to a steam-engine cylinder. *a*, is the cylinder; a^1, the piston, provided with valves *b*; *c*, is the piston-rod; and *d*, the packing or ring of hemp or other elastic material, impregnated with oil to preserve its flexibility. *e*, *e*, are circles of iron, which screw the packing to the plane surfaces of the piston; *f*, is the stuffing-box; *h*, the packing; *i*, valves placed in the cylinder cover; *j*, circles of iron, which fasten the packing to the cylinder cover and stuffing-box; and *k*, a metal ring or washer, fitted to the piston or other rod, serving as a guide. Above the ring or washer is an oil-cup *l*, screwed to the stuffing-box, and which presses on the ring *k*, and keeps it in a vertical position. The piston is shewn as ascending, or making its upward stroke. The valves *b*, are made very light, and introduced, as shewn, in the thickness of the piston; and the steam, acting upon either side of the piston, opens the valves and introduces itself into a cavity a^*, made in the circumference of the piston, and acts as a spring against the interior surface of the packing *d*, which thereby prevents any communication above or below the piston. The steam above the piston, when it is ascending, opens the valves *i*, and acts in a similar manner upon the packing *h*, of the piston-rod *c*, as it does upon the packing *d*; and as soon as the piston commences to descend, the valves are closed, and steam is retained in the cavity b^*, of sufficient pressure to resist the force of the atmosphere, and keep the piston or other rod air-tight. For pumps in general, and where a high temperature is not to be feared, the packing before-mentioned may be replaced by leather, caoutchouc, or other similar material.

The patentee claims, "the piston for steam and other motive-power engines and pumps in general, as well as the employment of steam, gas, or liquid, acting upon the packing of stuffing-boxes, for the purposes and in the manner shewn and described."

To William Webster, *of Bunhill-row, for improvements in pumps,—being a communication.*—[Dated 23rd July, 1856.]

This invention relates to an improved construction and arrangement of pump, and consists in the employment of projecting or raised circular valve-seats in combination with elastic ball or spherical valves, which fit on to their seats closely, and operate freely without danger of choking, since the projection of the valve-seats effectually prevents such an occurrence.

In constructing a pump according to this invention, either one or more pump-barrels are employed, as found desirable, with or without an air vessel, each barrel being fitted, if found desirable, with a plunger, working through a stuffing-box, capable of being tightened up to any desired extent with facility, without in any way deranging the pump. A connecting rod may be jointed to the bottom of each plunger, and connected at its other end with a lever or vibrating beam, working on a fixed centre on the top of the air vessel, to which beam may be attached handles for working the pumps. The passage of water or other matters through the pump is effected in the usual manner of lift and force pumps.

In Plate I., is a longitudinal vertical section of the improved pump. *a, a,* are two pump-barrels, situated on opposite sides of the air-vessel *b*. The plungers *c, c,* which are nearly of the same diameter as the barrels of the pumps, are made hollow or in the form of trunks, and in place of carrying packing to fit the interior of the pump-barrels, they are packed tightly by passing through the stuffing-boxes *d, d,* at the top of the pump-barrels, by which means the packing may be easily tightened without removing the plungers. The connecting rods *e, e,* are jointed at *f, f,* to the bottoms of the plungers, and at their upper ends to the vibrating lever *g*, which works on a fixed centre *h*, on the top of the air-vessel. *i*, is the supply pipe; and *j, j,* are branch water-ways leading to the two elastic ball or spherical foot-valves *k, k*. These valves may either be composed of solid india-rubber, or of metal, enclosed in a casing of india-rubber. The valve seats *l, l,* are raised considerably above the level of the water-ways, the water or other liquid having to pass through the valve, and then to ebb or flow down the outside of the valve-seat; by which arrangement the liability to clogging or choking is obviated, since there is no space afforded for the lodgment of any foreign solid matter which the water may contain upon the valve or seat; and as the valve-seat is raised considerably, any solid matter which has passed through the valve will be prevented from returning back again, or becoming deposited in the opening of the valve. In consequence of the elasticity of the balls they always fit their seats closely, and as the rush of water at each stroke imparts a rotary motion to the ball, the points of contact between the valves and their seats are continually changing; hence an even and very slight wear of the valve takes place. *m, m,* are wires for preventing the balls from rising too far from their seats. The water-ways *n, n,* conduct the water to the second set of valves *o, o,* which open into the air vessel. These valves and their seats are similar, in every respect, to those hereinbefore described; the wires m^1, m^1, controlling the motion of the valves *o, o*. A hose can be screwed on to the lower part of the air vessel when used as a fire-engine. The air vessel being supplied alternately from the two pump-barrels by working the lever *g*.

The patentee claims, "First,—the application and use to and in pumps of elastic spherical or ball valves, composed either of solid india-rubber or other suitable elastic material, or of any suitable material for a nucleus, enclosed in an india-rubber or other elastic casing, as hereinbefore described. Second,—the application and use to and in pumps of raised valve-seats, as hereinbefore described. Third,—the application and use to and in pumps of spherical or ball valves, composed as hereinbefore described, in combination with raised valve-seats, as hereinbefore described."

To Andrew Peddie How, *of Mark-lane, for improvements in pumps.*—[Dated 18th August, 1856.]

This invention relates to improvements in the arrangements of pumps, whereby each pump is rendered double acting, and two double-acting pumps are formed so as to occupy but little more room than a single-acting pump of the ordinary construction.

In Plate I., fig. 1, is a sectional elevation of pumps and valve-boxes constructed according to this invention; fig. 2, is a sectional plan of the same; fig. 3, shews in sectional elevation, and fig. 4, in sectional plan, modifications of the pumps and valve-boxes shewn at figs. 1, and 2. *a*, is a cast-iron or brass suction chamber, serving also as a foundation for the pumps: this chamber *a*, has four apertures *b*, *b*, *c*, *c*; the two *c*, *c*, join the valve-cocks *d*, which are so constructed as to act as stop-valves, the wheels *e*, *e*, being used either for screwing the spindles *f*, up (thereby allowing the stems of the valves *g*, to rise up in the recesses *h*, cast in the spindles *f*,) or for effectually closing the valves *g*, by lowering the spindle *f*, on to the stems of the valve *g*. The cocks *d*, have branches *i*, and *k*, one to be used as a suction for a fire-engine, and the other as a suction from the sea or any other source from which the liquid is to be drawn. *l*, *l*, are the pump-chambers, fitted with pistons *m*, *m*; *n*, is the under suction chamber, fitted with an india-rubber valve *o*, forming communication between the suction chamber *a*, and the pumps *l*, *l*; *p*, is the passage for the water from the suction chamber *a*, to the upper suction valves *q*, where it flows through the passages *r*, and r^1, to the top of the pistons *m*, *m*; *s*, *s*, are also passages from the suction chamber *a*, to the under side of the pistons *m*, *m*; *t*, *t*, are the delivery valves, having recesses *u*, formed in them, to allow the stems of the suction-valves *q*, *q*, to rise in them, thus acting as guides; *v*, is the delivery valve box, having branches *w*, in it, to which may be attached the delivery pipe or fire hose. The cap *x*, of the valve box *v*, is also provided with a recess *y*, in which the stem of the delivery valve *t*, rises,—thus acting as a guide for both the delivery and upper suction valves. *z*, *z*, are lugs cast on the delivery-valve box, for carrying the standard that supports the lever z^1, for working the pumps. This lever is connected by side rods to the pump pistons *m*, *m*. Handles, with sockets to fit the ends of the lever z^1, are provided, which can be removed at pleasure, as more or less hands are required for doing the work,

The only difference in the pumps shewn at figs. 3, and 4, is in the disposition of the valves, which, in fig. 3, are shewn placed at the bottom, and at fig. 1, at the top,—the working of the pumps being the same in both cases.

The action of the pump and fire-engine is as follows:—Either of the openings *b*, *b*, or *c*, *c*, of the suction chamber *a*, being opened, and the pumps set to work, the down stroke of one of the pistons *m*, causes the water to flow through the india-rubber valve *o*, into the passage *p*, which raises the suction valve *q*, and thence goes through the passage *r*, to the top of the pump piston *m*. The pump chamber under the piston being full of water, delivery takes place through the passage *s*, to the top of the upper suction valve *q*, which raises the delivery valve *t*, and forces the water out through one of the delivery outlets *w*. At the same time the other

pump piston ascends, the pump chamber being previously filled on the top of the piston by its down stroke, delivery takes place through the passage *r*, above the upper suction valve *q*, passes also through the delivery valve *t*, and from thence through one of the outlets *w*. The action is thus continuous, each pump being double-acting, and performing the same work that two separate double-acting pumps could do, although only occupying the same space as one.

The suction chamber which forms the foundation for the pumps is formed of one casting only, and the pump chambers, suction and delivery passages are also formed in one piece. In order to examine the delivery and suction valves the cap only requires to be unscrewed, and both valves can then be taken out, as the stems of the suction valves work in the recesses of the delivery valves.

The patentee claims, "the mechanical arrangement of pumps, valves, and passages, hereinbefore described and represented in the drawings, wherein each pump is rendered double-acting."

To Alfred Vincent Newton, *of the Office for Patents, Chancery-lane, for improved apparatus for raising water by atmospheric pressure,—being a communication.*—[Dated 16th September, 1856.]

This invention relates to a novel arrangement of apparatus adapted to raise water to any required height by the pressure of the atmosphere, the chief object being to discharge large volumes of water from mines with great rapidity, and with a smaller consumption of power than is at present required to obtain the like result. When applying the invention to the pumping out of water from mines, a series of exhaust vessels or air-tight tanks is provided, and set one above the other at suitable distances apart. These tanks are connected with each other by means of pipes, so as to form a water channel extending from the bottom of the mine to the elevation at which the water is required to be discharged. Connected to each of these tanks, by means of branch pipes, is an exhaust-pipe, which leads to and connects with an exhaust-pump, actuated by the motive power engine at the top of the main shaft. By the action of the exhaust-pump a partial vacuum is obtained and kept up for the requisite period in the several tanks, and the water which has access thereto by induction pipes will thereby be caused to flow upwards, filling first the lower tank, the contents of which will be discharged into the tank immediately above it by the downward pressure of the air, which is at the proper time admitted into that tank; and so in like manner the water will be caused to mount to the top of the series of tanks, and flow from the last of the series, by the discharge pipe provided for the purpose; a suitable arrangement of valves being employed to stop the flow of water up the induction pipes, and also to admit air to cut it off from the tanks, and to stop and renew the action of the exhaust-pipe.

In Plate I., fig. 1, represents, in side elevation, the apparatus employed for raising water according to this invention; and fig. 2, is a sectional elevation of one of the air and water-tight tanks.

The exhaustion in this apparatus may be effected by the use of steam or other available motive power. *a*, fig. 1, represents a steam-engine used for this purpose; and *b*, *c*, is the gearing for transmitting a reciprocating

motion to the pistons of the pumping cylinders *d, d*, which are mounted horizontally upon suitable framing. Connected with both these cylinders is the exhaust-pipe *e*, which is connected by branch pipes with a series of metal tanks f^1, f^{11}, set one above another, or at different elevations, in the shaft of a mine, at distances apart somewhat less than thirty-two feet, which, as is well known, is the height that water will rise under atmospheric pressure. These tanks are severally provided with water induction and eduction pipes g^1, g^{11}, which carry at their upper extremities two hinged valves *h, h*, set slanting at the mouth of the tube. The lower extremities of these tubes extend down to nearly the bottom of the next below it, as shewn at i^{11},—the lowermost one extending down to the water to be raised, and the upper extremity of the topmost one extending to the exit orifice. Thus the eduction pipe of one tank forms the induction pipe to the tank above.

An arm *l*, having its fulcrum at *m*, carries at certain distances two valves *n*, and n^1; the one *n*, serving for the re-admission of the external air, and the other n^1, for arresting the action of the vacuum produced in the tanks by the exhaust cylinders *d*, d^1. The arm *l*, carries at its extremity a pendent rod *o*: this rod, which is of iron, is of a round form, and provided with stops or shoulders *p*, and q^1, and it slides up and down in an opening *q*, in the stuffing-box *r*. *s*, is a hollow metal float filled with air, and having an opening through its centre, which will allow of its sliding upon the rod *o*, without imparting any motion to it.

The operation of the apparatus is as follows:—Motion being communicated to the steam-engine, it will, by means of the pneumatic or exhaust cylinders, create a partial vacuum in the tanks f^1, f^{11}, through the air-pipe *e*: at this stage of the operation, all the exhaust-valves n^1, are open, and the valves *n*, for admitting air, are closed, the lever-arm *l*, being in a lower position than that represented in fig. 2, and the stop or shoulder p^1, of the rod *o*, bearing upon the box *r*; the float *s*, also resting upon the top of the shoulder p^1. When a sufficient amount of exhaustion has been produced in the tanks, the water will rise from the bottom of the mine and fill the first tank: on arriving at the level *u*, the float, which the water has caused to rise, will strike against the upper stop *p*, of the rod *o*, and will communicate motion to the arm *l*, thereby closing the exhaust-valve n^1, and opening the valve *n*, for the admission of air. The atmospheric pressure thus created on the water contained in the first tank will cause it to rise into the second tank, through the induction pipe g^1, which connects the two tanks together; and in like manner the water will pass to the other tanks of the series until it arrives at the discharge-pipe.

Fig. 3, is a vertical section of a modification of the air and water-tight tank, with its appurtenances, shewing both the induction pipe *h*, and the eduction pipe h^1. *a, a*, are vertical cylinders, which may be made of cast iron, and communicating with each other, they form a common cylinder. *b*, is a cover provided with two valve-boxes *a**, *b**, and carrying the guide-rods for the valves *c*, and *d*. The valve *c*, serves for the introduction of air from the atmosphere into the tank; it is fitted with three wings or feathers, which fit into and work up and down in the valve-box *a*. The valve *d*, serves for the discharge of the air from the tank to the pipe *c**, which communicates with the air-pump. *d**, *e**, are brackets or supports, cast on to the cover *b*. The bracket *d**, carries bearings for the axle of a weighted crank-lever *e*, which is intended to raise the valve *c*, from its seat;

and the bracket *e**, carries at its upper part *g**, a guide piece for the rod *h**, of the valve *c* : *i**, is the guide-rod of the exhaust air-valve *d*. These two valve-rods *h**, and *i**, are provided at their lower parts with rectangular openings, through which passes the lever-arm *f*, which rocks upon the fulcrum-pin or axle *k**, carried by the pendant bearing *l**. *g*, is a hollow metal float, adjusted so as to slide up and down on the pendent-rod *m**, provided at its upper extremity with a shoulder or stop *n**, and at its lower extremity with another stop *o**, for the float to bear against. The lower extremity of the pendent-rod *m**, works in a box *p**, cast on the lower part of the reservoir. The water rises into the reservoir through the pipe *h*, which is provided at its upper extremity with a double-hinged valve *i*, *j*, working on an axle at *q**. The discharge of water from the tank into the tank above is through the pipe *h*¹, which is provided at its lower extremity with a conical valve *k*, having its seat at *r**, *r**. The pipe *h*, is fixed to the bottom of the tank by a bridle-piece *s**, *t**, and the pipe *h*¹, to the top of the tank by the bridle-pieces *u**, *v**.

The operation of the apparatus is as follows :—On setting it to work, the arm *f*, is at its lowest position, the float *g*, bearing upon the stop *o**: the valve *d*, is open and the valve *c*, is closed,—the rod *e*, carrying the ball, being in a vertical position. On putting the air-pump into operation, a vacuum will be produced in all the tanks of the series, whatever may be their number, by means of pipes *c**, communicating with them all. When the equilibrium between the air contained in the tank and the external atmosphere has been destroyed, the atmospheric pressure will act upon the surface of the water below, and will cause it to ascend into the tank immediately above it. The water on entering this tank through the double valve *i*, *j*, will raise the float *g*, and cause it to slide upon its rod *m*; and when the water has reached the level shewn by the dotted line *l*, *m*, the float will act upon the lever *f*, with a force proportioned to the volume of water displaced by it, and cause it to rise; by which means the vacuum-valve *d*, will be closed, and at the same time the weighted arm of the lever *e*, will fall from its vertical position (describing a portion of a revolution on its axis *f**,) and thereby open the air inlet-valve *c*. Air will thus be allowed to enter the tank, and, pressing upon the surface of the water contained therein, it will cause the water to pass off by the outlet or escape valve, and ascend into the tank immediately above. From this apparatus, which is caused to act in precisely the same manner as the preceding one, the water is in like manner discharged, and so on until it has arrived in the uppermost tank, whence it escapes freely through the weighted exit valve *n*. This valve is set at an angle of 45°, and the weighted rod upon its hinge is vertical during the ascent of the water in the reservoir to which it belongs, which position it retains until an increase of pressure is caused by the re-admission of the external air into the reservoir, whereby the valve is opened and the weight *o*, forced back. On falling backwards it presses upon a spring *p*, which causes it to resume its vertical position when the water has passed out.

In order to ensure regularity in the working of the apparatus, the weighted lever *e*, should have sufficient power to maintain the arm in the position represented in fig. 3, whilst the float descends on its rod *m**, following the level of the water which is flowing out; and it is necessary that as soon as the float bears upon the stop *o**, its weight should over-

come the weight of the crank lever *e*, and cause the instant closing of the valve *c*, and the opening of the valve *d*.

The advantages of this improved mode of raising water over the apparatus ordinarily employed for the like purpose, are, that whereas in the latter the weight of the column of water is permanent upon the pistons of the pumps (which column becomes heavier in proportion as the mine or the well is deeper), and necessitates the employment of very powerful machinery, this improved apparatus may be worked with comparatively little power, as it is only necessary to create a vacuum, and the simple pressure of the atmosphere will cause the water to ascend. Moreover, an increase of the height to which the water is to be raised does not necessitate the employment of apparatus constructed with greater strength and weight of material, but simply the employment of one or more additional tanks with their appurtenances. And, further, by making the pipes for the ascent of the water of sufficiently large diameter, results may be produced which could not be obtained with the ordinary apparatus.

The patentee's claim is, "the means herein described, or any mere modification thereof, whereby, through the application of the well-known principles of exhaustion and atmospheric pressure, I am enabled to cause water to flow upwards and discharge itself at any required elevation."

To HENRI PETITPIERRE, *of Batignolles, near Paris, for improvements in sawing or cutting stone.*—[Dated 11th March, 1856.]

THE object of this invention is to facilitate the sawing or cutting of stone by hand labor.

In Plate II., fig. 1, is a lateral elevation of the apparatus for actuating the saw. *a*, is the frame, mounted on three feet *d*, the front one of which is grooved: two arms *c*, *c*, support an axle *b*, furnished with the two wheels b^1, on which the machine rolls: four bearings *e*, *e*, fixed to the frame *a*, support the axles *f*, and *g*. The axle *g*, is terminated by a crank handle, or by a moveable pulley, and is supplied with a cog-wheel, which drives a pinion fixed on the axle *f*. The axle *f*, has at one of its extremities a crank-plate f^1, provided with several holes to be changed according to the direction to be given to the saws; and at the other extremity is a fly-wheel *h*. Attached to the plate f^1, is a connecting rod *i*, leading from an arm keyed on an axle *k*, which moves in bearings k^1. Attached to the axle *k*, is an oscillating rod *j*, pierced with holes to fit at a suitable height into the bar *l*, which transmits the to-and-fro movement to the saws. Fig. 2, is a lateral elevation of the sawing apparatus for one saw. *q*, represents the stone; and *p*, the saw, which is guided by two grooved guides or sills *n*, *n*, made fast on the stone, and in which the saw slides. The saw is governed by the bar *l*, above named, to which is attached a chain *m*, fixed to the bar of the frame of the saw in order to regulate its traction. *r*, is a vessel, with a division to contain the water and the grit, furnished with a valve and tap; and *t*, is a gutter into which the water and grit fall. Fig. 3, is a lateral elevation of a frame for several saws. The blades of the saws are suitably fixed at the two extremities of a horizontal frame *t**, of which the two lateral bars are fixed between four pairs of posts *v*, *v*, mounted on two wooden frames *u*: the lateral bars roll between the posts on rollers *z*, placed on axles *w*, which slide between each pair of posts, and

are sustained by chains *x*, connected with pulleys. The transverse bars forming the ends of the frame are inclined towards their ends, to elevate the extremity of the frame at the moment when one or other of the ends bears upon the rollers *z*. The object of this is to effect what is called the tilting or lifting up of the saw, so as to allow room for the water and grit to pass under the saw. Moveable drums *y*, fixed at the extremities of the beams *v*, *v*, outside the posts, are each furnished with a chain, one end of which is fixed to the drum, and the other bears a counter-weight, intended to balance the frame and keep it at a proper height. The frame *t**, is attached by one of its ends to the bar *l*, which communicates to it its to-and-fro motion. The supply of water and grit is obtained by any suitable continuous means by modifying the system indicated for one saw, as shewn in fig. 2.

The patentee claims "the combination herein described."

To Louis Guillaume Perreaux, *of Paris, for an improved valve.*— [Dated 8th May, 1856.]

This invention of an improved valve consists in a short passage of vulcanized caoutchouc or other suitable flexible material, of a certain peculiar form, somewhat resembling the mouth-piece of the musical instrument called a hautboy. The form of this passage is such that it allows fluid to pass through it in one direction only.

In Plate II., fig. 1, shews a transverse section of one of the improved valves when closed, as constructed for the purpose of the piston-valve of a lift-pump; fig. 3, a plan view of the same; fig. 2, shews a plan of the valve attached to the piston-rod of a lift-pump; and fig. 4, is a section of a portion of a lift-pump, shewing the application of both the piston and foot or cylinder valves. *a*, is the short passage of vulcanized caoutchouc; *b*, the wall forming this passage. This wall, it will be seen, is made gradually to taper upwards from its base at *c*, *c*, till it terminates in two long narrow lips at *d*, *d*, which remain in easy contact so long as the valve is at rest, and are only more firmly compressed together by any downward pressure of the fluid in contact with them; but they separate freely to allow the passage of any upward current of the same fluid, as shewn by dots in fig. 1. The other parts of this valve, by which it is secured in its place, may be variously modified to suit the particular purpose for which it is required. When employed as the piston-valve in a lift-pump of moderate size, it is preferred to construct it and the piston *g*, of one piece of vulcanized caoutchouc. The mode in which this piston is then connected with the piston-rod will readily be seen by reference to fig. 4; in which *e*, is the piston-rod; e^1, e^1, a stirrup-formed iron, which connects the piston-rod *e*, with the metal hoop e^{11}. To connect this valve and piston with the piston-rod *e*, it is only necessary to compress the piston *g*, within the metal hoop e^{11}, which is made to fit accurately between the flanges g^1, g^1: the piston will then be retained in position by its own elasticity. These flanges g^1, g^1, are made to fit and press upon the interior of the cylinder of the pump. When the improved valve is to be employed as the foot or cylinder valve of a pump, it may be constructed with a wide shallow flange, which then serves both to secure the valve in its place, and also as a washer for the joint which connects the cylinder *i*, with the suction-pipe *k*.

To John Cartwright, *of Shrewsbury, for improvements in agricultural implements called chain-harrows, for more effectually dressing and cleaning land.*—[Dated 17th July, 1856.]

This invention is designed for the purpose of rendering chain-harrows self-clearing, and consequently more efficient than those hitherto employed. In chain-harrows, as heretofore constructed, the links have been invariably formed all of one size, strength, or weight throughout, and the consequence has been, that if the chain was heavy enough to break up the clods, it was too heavy to clear itself, but dragged the soil and "couch," &c., along with it, and became clogged. The improvement consists in making such chain harrows with the links gradually decreasing in weight, that is to say, with heavy links in the first section, and with each succeeding section or sections formed of links of a lighter construction. By this arrangement, a great improvement in the dressing and cleaning of the land is effected, and a great deal of time and labor saved: the clods are broken up by the first or heavy section of the chain-harrow, and the succeeding or lighter sections pulverize the soil still finer, beating the couch, &c., perfectly clean, which (instead of clogging or choking the harrow) becomes rolled together in a mass or wisp, and left behind upon the surface of the land,—the harrow itself never requiring to be cleaned.

The figure in Plate II., represents a plan view of the improved chain-harrow. *a, a,* is a bar to which the horses are to be attached by chains hooked on to the rings *b, b*; *c, c,* are links connecting the chain-harrow *d, e, g,* to the bar *a, a*; *h, h,* are bars to keep the harrow distended. It will be observed that the foremost links *d,* of the harrow are the heaviest, and that they gradually decrease in weight—the links *g,* being lightest. By this method of constructing chain-harrows, the clods are first broken by the first or heavy links *d, d,* the soil is pulverized still finer, and the couch, &c., beaten perfectly clean by the intermediate links *e, e,* and *f, f*; whilst the last or lightest links *g, g,* serve merely to roll the couch, &c., into a wisp, and leave it on the surface of the land.

The patentee claims, making agricultural implements, called chain-harrows, with the links gradually decreasing in weight, in the manner and for the purposes above particularly set forth, without confining himself to any particular form of the links themselves, or to any particular sectional form of the rod from which the links may be made.

To Alexander Wright, *of Millbank-street, Westminster, for improvements in lighting mines and subterranean places with gas.*—[Dated 4th August, 1856.]

This invention relates to a peculiar combination of apparatus for lighting mines with gas, and consists in so combining apparatus at the summit of a mine, or other similar deep place, that the gas, having been produced in the ordinary manner, may, by pumping or forcing apparatus, be forced into a gas-receiver or holder weighted to a higher degree than ordinarily, and by means of a governor, be regulated to the degree of pressure required in the mine or such like deep place. The weighting of the gas-receiver or holder will, to some extent, depend on the depth of the mine; and the weight required in each case must be such, that the pressure given

by it shall be greater than the difference of weight of a column of air and a column of gas, the whole depth of the mine or subterranean place intended to be lighted, together with the additional pressure necessary for the friction in the pipes, and for projecting the gas to supply the flames. It is preferred, in all cases, to have the pressure of the gas in the receiver into which it is forced, in excess of the actual pressure necessary, and to regulate the pressure between the gas-receiver and the mine, or such like place, by a governor, to the degree of pressure required to force the gas down into and to distribute it in the mine. In mines a thousand feet deep, or less, a pressure of about fifteen inches of water may be used, and a greater pressure if the mine be materially deeper.

The figure in Plate II., shews an elevation, partly in section, of the apparatus at the summit of a mine. *a*, is a pipe leading from a gas-holder of the ordinary construction; or the gas might be conveyed direct by the pipe *a*, to the pumping apparatus, without being first stored in a gasometer; and be, by the pumping apparatus *b*, forced into the gas-receiver *c*, which in form and arrangement is such as is ordinarily used. But it is preferred to construct it of a series of curved plates of cast-iron, with outer flanges, by which a great weight is obtained at little cost; which is also advantageous, as greater weight is required for this gas-receiver than those ordinarily used, by reason of the far greater pressure necessary, practically, to accomplish the lighting of mines and deep places by gas, than is required when lighting mines, as well as other places, by gas, under other circumstances. *d*, is a pipe from the pump or forcing apparatus *b*, to the tank *e*, of the gas-receiver *c*; which receiver is, as before explained, weighted, so as to obtain the extent of pressure requisite to force the gas down into the mine. f, f^1, are the supply pipes or mains from the gas-receiver *c*, to the bottom of the mine; there being a governor *g*, of an ordinary construction, connected between the supply pipes or mains f, f^1. At the bottom of the mine, the gas brought down by the main f^1, is distributed by branch-pipes, in the ordinary manner of gas-lighting, and according to the requirement of the particular mine, or such like deep place; and suitable gas-fittings, at proper intervals, are applied to the pipes, in order to burn the gas by suitable burners; and, when preferred, such burners are to be within suitable lamps, as is well understood, and separately they form no part of the invention.

The patentee claims, "the combined means herein described."

To William Oldham, *of Southam, Warwickshire, for improvements in the manufacture of cement, and in treating or preparing coloring matter for cements.*—[Dated 10th September, 1856.]

In the manufacture of cement from lias lime, the practice has heretofore been to calcine the limestone, and subsequently to mix and grind it with clays or other suitable matters.

This invention consists in first grinding the lias limestone to a powder, either separately, or with a suitable admixture of clays. The limestone and clay, mixed either before or after grinding the limestone, is then rendered plastic, and formed into suitable cubes or shapes, for the purpose of burning or calcining: these are subsequently reduced to powder by grinding to a state suitable for cement. By this means, the lias lime is never

slacked until it is used in the state of cement, when it will set better and more readily under water, and will possess other properties as a cement, superior to cement of ordinary manufacture. A further improvement consists in reducing the lias limestone by means of stones similar to mill-stones used for grinding wheat.

In preparing the coloring matter for cements according to this invention, the coke, breeze, coal, coal-slag, or charcoal, used for that purpose, is ground to a fine paste or powder while in a wet state; after which it is dried and re-ground with the cement. By this means a coloring matter is obtained, which imparts a more uniform and permanent color to the cement than can be produced by grinding those materials dry, and mixing them with the cement, as practised heretofore.

In preparing cement according to this invention, the patentee proceeds as follows:—The lias limestone is first broken, by means of hammers, into lumps, of a size suitable to be submitted to further reduction by means of spiked rollers, by which it is at first crushed: having been so crushed, it is further reduced to powder by means of horizontal millstones. The clay is mixed with the lias limestone either before or after grinding it to a powder. In case of mixing the clay after grinding the limestone to powder, the clay should also be previously reduced to a powder, or to a state of pulp. Instead of clay, other earthy material may be used, such as river and other suitable mud. The compound is now rendered plastic, and moulded in bricks or other suitable forms, for subsequent operation: after moulding, the bricks or forms are allowed to dry, and are then calcined in the ordinary manner of burning or calcining argillaceous materials. After calcining the limestone and clay, or other material, prepared and mixed as hereinbefore described, the calcined material is again subjected to grinding between millstones, such as before mentioned, by which it is reduced to a fine powder, which is used as a cement in the ordinary manner. Previous to this second grinding, the coloring matter, before mentioned, is mixed in proportion, according to the color required, as is well understood in the manufacture of cement. The proportions of limestone and clay, or other material used in this manufacture, depends considerably upon the qualities of the limestone and clay, or other material, used in the manufacture. The proportions preferred are about two parts of limestone to one part of clay.

The patentee claims, "First,—crushing and grinding lias limestone, and mixing the same with clays, or other suitable materials, previous to calcining, in the manufacture of cement, as hereinbefore described. Secondly,—the use of horizontal stones, such as hereinbefore described, for grinding lias limestone previous to calcining the limestone in the manufacture of cement. Thirdly,—wet grinding and preparing coloring matter for coloring cements, as hereinbefore described."

To James Atkinson Longridge, *of Fludyer-street, Westminster, and* Thomas Richardson, *of Newcastle-upon-Tyne, for an improvement in constructing the fire-boxes of locomotive steam-boilers.*—[Dated 9th October, 1856.]

In constructing the fire-boxes of locomotive steam-boilers, according to this invention, the front part of the fire-box is brought forward or

extended at a point above the fire-bars, so as to produce an internal shelf below the fire-door, but above the fire-bars. The front of the fire-box is made double, as heretofore, in order to form part of the interior capacity of the boiler, and such is the case with that portion which constitutes the shelf or internal projection. The fire-door, or the front of the fire-box, is perforated, in order to supply air to the coal placed on the shelf or internal projection, to aid in consuming the products evolved from the coal placed on the shelf. By this arrangement or construction, the coal will be coked on the shelf or internal projection, before it is moved on to the fire on the fire-bars.

The figure in Plate II., shews a longitudinal section of part of a locomotive steam-engine boiler, with the improvement applied. *e*, represents the ordinary fire-box, having the fire-bars *a*, *a*; *c*, is a water space which divides the fire-box from the compartment *f*, of the fire-box, and forms a bridge to the shelf *d*, on which the coking of the coal is performed: the whole of this shelf may be formed into a water space, provided that there be sufficient air openings through the door, and through the front of the fire-box; but it is preferred to make the shelf *d*, only partly a water space, and partly of a perforated shelf, or it may be of bars tolerably near together. On this shelf the fresh coal is fed from time to time, and the fireman only removes the well-coked fuel into the compartment *e*, from the compartment *f*, of the fire-box. In commencing to use this form of fire-box, the fire is first lighted with coke, in the compartment *e*, of the fire-box, and fresh uncoked coal is placed on the shelf *d*; and as the same becomes well coked, it is, by the fireman, passed from the compartment *f*, into the compartment *e*, of the fire-box.

To JOSEPH BENNETT HOWELL, *of Sheffield, for improvements in the manufacture of cast-steel.*—[Dated 9th October, 1856.]

THIS invention consists in using what is commonly known as the scale which falls off steel or iron during the process of hammering or rolling, in addition to the ingredients in common use, for making cast-steel. The patentee does not confine himself to the use of any given quantity of the said scale, as that must be determined by the particular temper of steel required for any special purpose; the object of the invention being, to make a superior quality of cast-steel, or a homogeneous metal, from the commoner kinds of iron.

The patentee claims, "the application of the within-named scale to the manufacture of cast-steel."

To JEAN ALEXANDRE LABAT, jun., *of Bordeaux, France, for improvements in closing or stoppering bottles, jars, and other like vessels.*—[Dated 10th October, 1856.]

THIS invention relates to improvements on a patent granted to the present patentee on the 28th day of September, 1853, for an improved system of closing or stoppering bottles, jars, and other like vessels, and consists chiefly in casting the metal screw-threaded collar therein described, on the neck of the bottle or other vessel, instead of making it moveable.

In Plate II., figs. 1, and 2, represent the necks of two bottles, one provided with a groove on the outside, and the other with notches or indentations; the object of the groove or notches being to receive the metal collar and retain it. In carrying this invention into practice, notches or indentations are preferred, rather than the grooved system, as the metal, during the operation of casting, enters the notches, and acts as rivets.

Fig. 3, represents a bottle neck in the mould ready to have the collar cast thereon; fig. 4, represents a neck of a bottle with the collar on the notched system; and fig. 5, is the capsule ready to be screwed thereon.

The capsules or stoppers may be punched out and afterwards supplied with the screw-thread, or they may be cast complete in one operation. The latter method is preferred, and for that purpose a mould, such as represented by figs. 5, 6, 7, 8, and 9, is used; the two projections on the top of the capsule, for screwing it tightly on the bottle, being cast at the same time, as shewn by dotted lines, fig. 9.

The patentee claims the "construction and application of fixed screw-threaded collars and capsules or stoppers to screw thereon, for closing bottles, jars, and other like vessels, as herein set forth."

To LEOPOLD ADOR *and* EDOUARD ABBADIE, *both of Paris, for improvements in the manufacture of colors from metals, and in the furnaces or apparatus for the same.*—[Dated 11th October, 1856.]

THIS invention consists, first, in the manufacture of colors by means of salts of zinc, and of certain other metallic salts: second, in the arrangement of the apparatus and processes employed in this manufacture.

Oxide of zinc, which forms the base of the manufacture, is obtained by the decomposition of salts of zinc by means of heat, either in furnaces or retorts. The advantages which these colors offer are their wholesomeness, combined with solidity and economy. When this oxide of zinc results from the decomposition of sulphates, monohydrated sulphuric acid (acid of Nordhausen) is disengaged from it, and there remains oxide of zinc, which, combined with other metallic oxides, produces all kinds of colors, shades, or tints.

The sulphate of zinc to be employed is prepared as follows:—Metallic zinc is decomposed by means of sulphuric acid, of a strength of from eighteen to twenty degrees Beaumé. When the liquid is completely saturated it is allowed to remain some time in order that it may be decanted in a clear state: it should now mark from thirty-six to thirty-eight degrees Beaumé; it is then evaporated to a pasty consistency in leaden vessels heated by an open fire,—care being taken to agitate the matters until the leaden vessel is removed from above the fire, so as not to allow the bottom of the heater to melt. The sulphate of zinc is taken out, thus thickened, on plates of zinc or lead, when it is left to cool, by spreading or dividing it as much as possible with a spatula of wood.

The apparatus which serves for this conversion of pieces of zinc of all sizes into sulphate of zinc in a mass, by the aid of sulphuric acid, is represented in Plate II., at figs. 1, and 2. Fig. 1, is a vessel of stoneware, of a capacity to contain about seventy-five gallons, in which the clippings of zinc are dissolved with sulphuric acid till the zinc is completely

saturated. Fig. 2, is a transverse section of the furnace, containing the boilers serving to evaporate the liquors from the sulphate of zinc. *a*, is the brickwork; *b*, the fire-places; *c*, the ash-pit; and *d*, the boilers of lead in which the liquid sulphate of zinc is evaporated until it attains a pasty consistency.

The mixture of metallic salts by which the several colors are obtained, supposing their manufacture to be with sulphate of zinc, is as follows:—

Delicate yellows, called Roman yellows, are obtained by the simple decomposition by heat applied to the sulphate of zinc in the retorts or in the furnaces hereinbefore described. Chamois yellows or buffs are obtained by mixing one hundred parts of sulphate of zinc in solution with one-and-a-quarter parts of a solution of sulphate of iron, marking twenty-eight to thirty degrees Beaumé. Delicate buffs or chamois yellows are obtained by mixing one hundred parts of sulphate of zinc in solution with two-and-a-half parts of a solution of sulphate of iron, marking twenty-eight to thirty degrees Beaumé. Chamois or buff yellows of the deepest hue are obtained by augmenting, in proportion to the depth of the tint required, the quantity of the solution of sulphate of iron. Golden yellows are obtained by mixing to one hundred parts of sulphate of zinc in solution, two-and-a-half parts of a solution of azotate (nitrate) of manganese, marking from twelve to fourteen degrees Beaumé. Golden yellows of the deepest shade are obtained by mixing a larger quantity of azotate (nitrate) of manganese. Greens, called Scheele's green, are obtained by mixing to one hundred parts of sulphate of zinc in solution, two-and-a-half parts of a solution of nitrate of cobalt, marking twenty degrees Beaumé. Greens of the deepest shade are obtained by mixing a greater proportion of nitrate of cobalt. Greys are obtained by mixing to one hundred parts of sulphate of zinc in solution, two-and-a-half parts of a solution of sulphate of copper, marking twenty degrees Beaumé. Greys of the deepest shades are obtained by mixing a greater proportion of sulphate of copper. Delicate yellow greens are obtained by mixing to one hundred parts of sulphate of zinc, first, two-and-a-half parts of a solution of nitrate of nickel, marking fifteen to sixteen degrees Beaumé; and secondly, some drops of a saturated solution of azotate (nitrate) of silver. Bronzes are obtained by adding to one hundred parts of sulphate of zinc, first, three parts of a solution of azotate (nitrate) of nickel, marking fifteen to sixteen degrees Beaumé; secondly, three parts of a solution of the same strength of azotate (nitrate) of cobalt; and thirdly, from one to one-and-a-half per cent. of a solution of azotate (nitrate) of copper of the same strength. Deep bronzes are obtained by employing the same agents in the same proportions, but subjecting them during a longer time to the action of the fire. Rose colors are obtained by mixing one hundred parts of sulphate of zinc in solution with from two to three parts of a solution of azotate (nitrate) of iron, marking twenty to twenty-five degrees Beaumé. Rose colors of the deepest hues are obained by augmenting the proportions of azotate (nitrate) of iron. Whites are obtained simply by employing sulphates of zinc in a very pure state, that is to say, freed from all other salts, principally salts of iron, which is tested by the chemical agency of cyanide of potassium. The greatest care must be taken in this last manufacture that the apparata or plant used, are perfectly clean. Thus, instead of placing sulphate of zinc on the sheets of lead or of zinc, they are run into vessels or pots of stoneware.

The several combinations of materials and chemical actions producing the colors indicated, require variable lengths of time for their transformation and completion, according to the apparatus, the heat of the fire, the colors, or the shades of color required. The operation must be watched attentively the whole time, and when the shade of color desired is obtained it must be removed quickly from the furnace.

The arrangement used when the colors are manufactured with retorts is represented in fig. 3, which is a longitudinal section of the retort furnace. *a*, is the brick-work; *b*, fire-place, furnished with grates of iron; *c*, ash-pit; *d*, retort, of ceramic fire-proof material, serving to oxidize the sulphates of zinc;—it is surrounded completely by incandescent charcoal. *e*, fire-brick supports, sustaining the retort *d*, at several points; *g*, plate of fire-proof ceramic material, maintaining the charcoal which surrounds the upper part of the retort *d*, and serving also as a separation between the fire-place and the passage *h*, by which the products of combustion escape, and which pass to the chimney *i*. Draft openings are made in the brick-work of the fire-place for the insertion of pokers to stir the fuel and maintain it in its position round the retort *d*, and also to remove the cinders. *k*, is a pipe for the escape of the gas.

Fig. 4, is a longitudinal section of an improved arrangement of reverberatory furnace for the manufacture of colors. *a*, is the fire-place; *b*, the ash-pit; *c*, fire-bridge of brick-work; and *d*, grating of platina or amianthus, of as close a make as possible (this grating being intended to prevent the cinders or particles of charcoal escaping from the fire-place). *e*, is the sole or hearth of the furnace; *f*, mouth of the furnace, serving to draw out the materials; *g*, vault or arch of the furnace; *h*, opening of introduction to the furnace; *i*, chimney by which the gaseous products escape; *j*, entrance by which the fuel is introduced; and *m*, the damper of the chimney. In front of the furnace an iron roller, supported by standards, is provided, on which the poker or instrument is rolled to withdraw the product.

The sulphate of zinc, in a plastic state, mixed with solutions of metallic coloring salts, is put into the retorts or into the furnaces, and the fire kindled: the action is continued from four to eight hours in retorts, and about half that time in the reverberatory furnaces. Openings in the sides permit the observation of the process in operation in the furnace, so that the material may be withdrawn when the required color is arrived at.

The colored oxides of zinc taken from retorts or furnaces, are detached from the sides, and reduced to powder by a cone mill, or by millstones, and afterwards bolted and sifted very fine.

Azotates of zinc, chlorides of zinc, and acetates of zinc, would produce analogous results: these, if treated in the same manner, and with the same metallic salts, would furnish similar colors. All kinds of colors, and shades of colors, may also be manufactured by mixing with the carbonate of zinc carbonates of all coloring metals; but in lieu of treating them in a liquid state, they are treated when dry and in powder. It is necessary that the carbonates of zinc (like the coloring carbonates of iron, of copper, of cobalt, of antimony, of manganese, of bismuth, of nickel, &c.,) should be very pure.

The proportions of coloring carbonate employed are never less than six per cent. of the weight to the carbonate of zinc, and this proportion is augmented according to the shade of color it is desired to obtain.

The operations occupy a period of two or three hours. When the color

and shade of color is obtained it is withdrawn from the furnace, pulverized, and sifted, as already described.

The patentees claim, "First,—the manufacture of colors completely mineral, the base of which is zinc, formed by salts of zinc mixed and treated with the salts of several other metals, in the proportions and as hereinbefore described. Secondly,—the apparatus represented in the drawings annexed, and hereinbefore described, for, or used in, this manufacture."

To TIMOTHY GILBERT, *of Massachusetts, U.S.A., for an improved piano-forte action or string sounding mechanism,—being a communication.*—[Dated 10th October, 1856.]

THE object of this invention is so to simplify a piano-forte action as to render it cheap in construction, to prevent "blocking" of the hammer at improper times, to avoid as far as possible the necessity of regulating or readjusting the operative parts with respect to one another, and at the same time to obtain a powerful action and secure to it ease of operation and delicacy of touch. In this action the jack or fly, as commonly used in piano-forte actions, is dispensed with, the devices employed for elevating the hammer being so arranged and actuated as always to maintain upon the key lever the weight of the hammer while it is in action; the same rendering the hammer sensible to the slightest downward movement of the key in whatever position it may be when so moved, or made to receive a blow or downward pressure from the finger of a performer. The back catch of the hammer will also be operated to great advantage, so far as concerns arresting the movement of the hammer after a blow from it upon its string has been produced.

In Plate II., figs. 1, and 2, are two arrangements for operating the hammer and its lifters constructed according to this invention. *a, a,* is the key lever; *b,* the hammer; and *c,* its arm, which is hinged to the hammer rail *d,* in the usual way. Hinged to the hammer arm, or otherwise properly applied to it, and near the rail *d,* is a short vertical post or arm *e,* (or its equivalent), which is connected to an inclined arm or lever *f,* that plays vertically on a fulcrum or pin disposed as seen at *g,* the same being arranged on an extension of the rail *d,* or in a separate supporting piece or rail. To the other end of the arm *f,* a small block *h,* having its working edge bevilled, or otherwise suitably formed, is applied so as to rest on and operate in connection with a lifter or butt *l,* which is fastened on a lever *i,* that is hinged to the key lever *a, a,* or turns upwards and downward upon a pin arranged as shewn at *k,* and within a projection from the lever *a, a.* The other end of the lever *i,* supports the back catch *m,* whose shank extends upwards from it. When the key is struck for the purpose of elevating the hammer, the butt or lifter *l,* will act against the small block *h,* in such manner as to raise it; whereby the inclined arm *f,* and the hammer will be forced upward simultaneously, so as to cause the hammer to approach and give a blow to its string. By reason of the peculiar manner in which the hammer is applied to the lifter or butt *l,* the weight of the hammer will be maintained on the butt during such time as it may be necessary or desirable to elevate the hammer towards the string; the same rendering the hammer very susceptible to any upward or downward movement of the key lever. By reason of the butt *l,* and the back catch *m,*

being connected with the key lever by a separate lever *i*, the back catch, immediately after a blow of the hammer against the string, will be elevated so as to arrest and hold the hammer, or prevent it from rising until the front end of the key lever is again struck downward; the back catch being raised by the action of the block *h*, against the adjacent corner of the lifter *l*, at or near the termination of the upward movement of the said lifter.

By the above-described or an equivalent arrangement of the afore-mentioned devices for operating the hammer, it will be seen that when they are once properly adjusted to one another, little or no readjustment of them will be necessary under ordinary circumstances. As the arm *f*, always serves to maintain the block *h*, in proper position on the lifter *l*, the hammer is kept in readiness for a blow, whatever may be its position relative to the string. The advantage of this when a note is to be repeated, "trilling" to be effected, or a powerful blow given to the string, will be readily apparent,—the possibility of improperly "blocking" the hammer being effectually guarded against: therefore the lifter *l*, or its equivalent, is made to operate either directly or indirectly against the inclined arm *f*, or any analogous contrivance applied under the hammer to elevate the same.

The patentee claims "the above-described peculiar manner in which the back catch *m*, and the lifter *l*, or its equivalent, are combined together and with the key lever, viz., by a lever *i*, hinged to the key lever, and fastened to both back catch and lifter,—the whole being substantially in manner and productive of advantages as hereinbefore set forth."

To William Rennie, *the younger, of Belfast, Ireland, for improvements in the condensing apparatus of steam-engines.*—[Dated 10th October, 1856.]

This invention relates to an improved mode of producing a vacuum in the cylinders of steam-engines, whether the steam be high or low-pressure, whereby the use of the ordinary air-pump is obviated, and, consequently, the prime cost of the engine greatly reduced, and its effective power increased to a considerable extent.

The figure in Plate II., is an elevation of the improved condensing apparatus, adapted to a sixteen horse-power high-pressure engine. *a*, represents the cylinder of a high-pressure steam-engine; *b*, the exhaust-pipe, which leads direet to the top of the condenser *c*. This condenser is placed at a considerable elevation above the hot well *d*, say thirty-five feet, and it communicates direct therewith by the water discharge pipe *e*. *f*, is the injection or cold water pipe; and *g*, the cock for shutting off or regulating the injection. The length of the exhaust and injection pipes will depend, of course, on the position of the engine, with regard to its elevation above the hot well: thus, if the hot well be sunk considerably below the engine, the condenser will be lower down, or nearer to the cylinder, and consequently the exhaust and injection pipes will be proportionately shorter. Before starting the engine, steam is blown through the pipes, for the purpose of expelling the air therefrom, and so producing a vacuum. The water from the hot well will thus be made to rise in the discharge-pipe *e*, by the atmospheric pressure, to the height of about

thirty-three feet, or to within a short distance from the condenser, and will remain at that elevation so long as a vacuum is kept up in the condenser. The injection water and water of condensation flow down the discharge-pipe into the hot well as fast as they enter the condenser; gravity alone serving to keep the condenser empty without the aid of an air-pump.

The patentee claims, "First,—the general construction and arrangement of condenser, either for high or low-pressure engines, as hereinbefore described. Second,—the placing of a condenser, whether for a high or low-pressure steam-engine, at such an elevation above the hot well, that the discharge-pipe, between the condenser and hot well, will be kept full or partially full of water by atmospheric pressure, whilst the water of injection and condensation is free to discharge itself from the condenser by gravity alone, without the necessity of an air-pump."

To GEORGE WILLIAM VARNELL, *of Camden Town, for improvements in mounting troughs, mangers, and apparatus used for feeding horses and other animals.*—[Dated 11th October, 1856.]

THIS invention has for its object improvements in mounting troughs, mangers, and apparatus used for feeding horses and other animals. For these purposes, when for the stall of a stable, the manger, the hay rack, and the water vessel are formed with or affixed to the back of a short partition formed at the head of a stall, in such manner that the partition, being capable of moving to and fro, or inclining forwards on its bottom or lower edge, will bring with it the manger, rack, and vessel into the stall of the stable beyond the upper part of the partition, so as to be accessible to the horse, and admit of the horse feeding or drinking; but when the lower or short part of the partition is brought into an upright position, the manger, rack, and vessel will be behind the partition which is formed at the head of the stable, and the partition or head of the stall becomes flush, by which means the manger, rack, and vessel are not accessible to the horse, excepting at such intervals as may be fixed for feeding,—thus tending to prevent the habit of crib-biting. In like manner can the troughs or vessels for feeding cows, pigs, and other animals, be mounted.

In Plate II., fig. 1, is a section of the end of the stall of a stable, fitted with feeding apparatus arranged according to this invention. *a, a,* are V-shaped iron frames, one on each side of the stall. These frames are connected together at their upper ends by means of the casting or manger plate *b,* which is bolted to them, and they are connected together at the bottom by a bar *c.* In the paving of the stall are firmly fixed the eyes *d, d,* which receive studs or pins projecting from the frames *a, a*; and the frames *a, a,* turn on these as centres. *e, e,* are boards, which are fixed against the edge of the manger plate *b,* and the bottom bar *c,* so as to form a part of the partition at the end of the stall. *f, f, f,* are three pans fixed to the under side of the manger plate; they are furnished with flanges at their upper edges, and are fastened to the manger plate by screws. One of the pans *f,* is intended to receive corn, another hay, and a third water: *g,* is the upper part of the wooden partition at the end of the stall.

When the horse is to be fed, the manger is turned forward into the position shewn in the figure, and the food may have been previously introduced

into it from the back of the stall, which is a great advantage in feeding vicious horses.

When the horse has done feeding, the manger is turned back until it is arrested by stops, which retain it at the position shewn by the dotted lines, so as to bring the boarding *e*, flush with the upper part of the end partition of the stall. The manger is fixed in one or other position by means of bolts, one on each side, which shoot into holes in the side partitions of the stall. The strap by which the horse is fastened passes through a hole in the boarding *e*, at e^1, and afterwards through a ring b^1, attached to the manger plate.

Fig. 2, shews an apparatus arranged according to this invention, and suitable for feeding pigs. *a*, is a frame which is fixed in the wall or side of the stye; this frame has a rectangular aperture through it, and at the lower part of the aperture, two pins or axes a^1, are fixed, and these enter eyes b^1, cast on the bottom of the trough *b*, at its ends. The two positions of the trough are shewn—the one by full and the other by dotted lines. To feed the pig or other animal, the food is introduced into the trough when turned out of the stye, and it is then turned on its axis so as to render it accessible to the animal.

To John Thomas Way, *of Welbeck-street, for improvements in obtaining light by electricity.*—[Dated 29th October, 1856.]

Heretofore in obtaining light by means of electricity, electrodes of charcoal have usually been employed, and motion has been given to such electrodes by clockwork or otherwise, so as constantly to change their acting points; but even with this precaution it has been very difficult to obtain a constant light, in consequence of the want of uniformity in the electrodes.

This invention consists in the use for one of the electrodes of a substance, such as mercury, which is caused to flow through an orifice or orifices on to a point or points of steel or other material. The mercury is in connection with one of the poles of the battery, and the points are in connection with the other pole of the battery; and they are so arranged that the distance between them, and the orifices from which the mercury escapes, can be adjusted so as to bring the points to the level at which the streams of mercury break into drops. In place of using points of steel or other material for the lower electrode, a regulated surface of mercury may be employed if desired, and the apparatus may be surrounded by a glass to prevent the escape of mercurial fumes: means also may be provided for raising the mercury from the lower receiver, into which it falls from the orifices to the upper receiver or cistern which supplies the jets.

The inventor uses a cistern of iron, slate, or other suitable material, in which the mercury is led by a pipe (with a stop-cock) to a jet, with a small orifice, from which, by its own weight, the mercury will flow in a constant stream: a height of from two to four feet will give a suitable pressure. The necessary pressure may also be obtained by mechanical means. When a small power only is employed, the mercury may descend on to a point of steel, platinum, charcoal, or other conductor, in connection with one pole of the battery,—the mercury itself being connected with the other pole. And it is important that the second electrode (or one of the electrodes) should be capable of ready adjustment, to insure its being at the point where the stream of mercury breaks, in order that there may be a

space between the stream and the second electrode. When the electric power is great, a point electrode is liable to be destroyed; and in such cases the patentee employs a small cup of mercury made of infusible material, such as fire-clay or other matter, so arranged that the mercury therein shall be in connection with one pole of the battery. The mercury should flow off only on one side from the small cup; for which reason the cup is made cylindrical, and about half-an-inch in diameter, with the upper edge higher on one side than the other, so that the edge is formed at an inclination or angle of 45°. The use of a small cup of mercury for the second electrode is important, as on the one hand it does not materially interfere with the light passing downwards, and at the same time the quantity of mercury subject to the heat is small, as compared with the quantity which would be present if the mass of mercury formed the second electrode. The mercury flows away by a pipe from below the small cup into any convenient receptacle; from which it may be returned by hand, by a pump, or other means, to the upper cistern. Finally, a glass is used to retain the fumes of mercury: the glass is cemented into the two cast-iron cylinders which form the upper and lower parts of the apparatus: this glass is to be as infusible as may be, and its size may vary from an inch in diameter to two inches or more, according to the size of the light to be produced. Instead of being a cylinder, the glass may be fixed in segments in a frame of metal; but in that case means must be taken to isolate one or other of the electrodes. Whether a metal or other conducting point or a cup of mercury be used, it is essential that means should be employed to adjust the distance between the two electrodes. For this purpose a screw, or rack and pinion, or other equivalent mechanism, is to be used in combination with one or other of the electrodes, in order that the distance apart of the electrodes may be regulated thereby, and that they may be retained at a distance apart corresponding with the breaking point of the stream of mercury.

The patentee claims "the use of a flowing electrode of mercury in combination with apparatus for regulating the distance apart of the two electrodes; and also the combination of a small overflowing cup or regulated surface of mercury, as a second electrode, with a flowing electrode of mercury, in apparatus for obtaining light by electricity."

To John Lord, *of Rochdale, for an improved admixture or compound to be employed as a substitute for oil, in the treatment of animal wool preparatory to carding.*—[Dated 19th November, 1856.]

In the treatment of animal wool before it is submitted to the operation of carding, as preliminary to its being manufactured, it is necessary to impart a certain degree of artificial greasiness or oiliness to the wool, in order to render it fit for such operation, and this quality has hitherto been imparted to it by sprinkling it in the bulk freely with oil. This invention is designed greatly to economise the cost of such operation, by substituting for such uses an admixture or compound, which may be prepared and employed at a very considerably less expense, and still be as beneficial to the purpose for which it is required.

As a substitute for oil, the following mixtures of ingredients are used:—To one quart of olive or other vegetable oil add three quarts of water, mixed with

about four ounces of crystallized soda, or other similar alkali: these are to be well amalgamated, stirred, and mixed together in a cold state for use, and to be used and employed exactly in a similar manner as, and as a substitute for oil, which has hitherto been used in the pure and unmixed state.

When used for wools in general (not submitted to acid) the alkali mixture may be made weaker, say, from about four to eight strong. Stronger may be used and mixed with the oil, as in the other case, and may be safely used in quantities of, say, twelve of alkali to ten or twelve of oil; but either greater or less quantities may be employed, olive oil being preferred. And when this alkaline oil is used for the purposes of lubricating or greasing machinery, the preparation is made as follows:—Powdered crystallized soda is mixed with olive or other vegetable oil, in the proportion of about four to six ounces of the soda to four quarts of olive oil. The oil is then ready for use, and will be found to be much better, and retain its lubricating properties much longer, than ordinary oil not so prepared.

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

In commencing the discussion upon Mr. Rennie's paper, "*On the employment of rubble-béton, or concrete, in works of engineering and architecture,*" the author gave some further details of works which had been alluded to, and particularly of the Pont de l'Alma. It was stated, that the material composing the arches was found originally to dry so irregularly as to cause cracks in several places. This was first remedied by forming large detached blocks of the concrete *in sitû*, and then cementing them together. But a further improvement was made. It was found, that in making an arch of nearly five feet in thickness, there was unequal expansion and contraction of the materials. To obviate this, a ring of small stones set in cement was first laid, on which the coating of Vassy cement concrete was spread. In fact, the arch was built in two rings. As regarded expense, it had been said, that the Pont de l'Alma had cost £40,000, but it was believed that £50,000 was more nearly correct. Now a bridge built at Liège, of dressed stone, of 550 feet in length and 30 feet in width, or 60 feet longer and half the width of the Alma bridge, had cost only £26,000. This did not shew any great economy in cost, in favor of the use of concrete; but as regarded time, the one was built in nine months, as stated in the paper, whereas the Liège bridge occupied three years in its erection.

It was presumed, that the paper was to be taken as a history of rubble and concrete up to a certain date, for it did not convey any idea of the extent of its use at the present time. There were now existing, in various parts of Great Britain, some remarkable works in rubble masonry, which had not been alluded to; amongst which might be mentioned the Liverpool and the Birkenhead Docks. It was thought that working in rubble had been greatly neglected, and that engineers had gone to the opposite extreme of building in expensive ashlar. But

what was to be most carefully guarded against, was the adoption of a hybrid style of masonry, consisting partly of ashlar and partly of rubble. This was looked upon as a dangerous system, as the unequal settling was almost sure to cause the ashlar facing to split, or part from the rubble backing.

It was remarked, as a generally received opinion, that concrete made with carefully washed gravel and sand, was preferable to that which contained an admixture of loam. Now, in some instances this had been proved not to be the case, for loam had been used with positive advantage. If expensive processes of making concrete were adopted, it would be better to resort at once to rubble work.

To this it was replied, that it had been shewn that the composition of the sand ought to bear some relation to the lime with which it was mixed, and that, under certain circumstances, the presence of marl in the sand was necessary. A careful examination of the treatises on the subject of rubble masonry, shewed that little was known as to the weight it would sustain, or the duty it would perform. It was of great importance to ascertain the resisting powers of rubble, composed of different materials, and set in different limes and cements; and also, the composition and action of the ingredients which entered into the concrete, or which were mixed up with the rubble.

A distinction ought to be drawn between concrete or béton, and rubble work. The former was generally used for foundations, or for making an apron between the piers of a bridge, to prevent the evil effects of scour; and also in breakwaters, where large masses of that material were thrown in. In rubble work, the stone formed about three-fourths, or five-sixths, of the whole mass; whilst in concrete, the proportion was very much less. In this respect, the material of ancient buildings occupied a place between the modern concrete and rubble, for in the works of the Romans the stone formed about one-third of the whole mass. The béton used in Russia had been subjected to a pressure of five tons per square foot. It was made of a particular clay, burnt according to the formula of Vicat, and thus a perfect artificial hydraulic lime had been formed, nearly equal to natural lime.

A description was given of the system followed by the late Mr. Walker, and Captain Huddart, in using washed gravel for the backing of quay walls at the East and West India Docks, and other places, by which great solidity was attained. Mr. John Rennie subsequently introduced the use of lime with the gravel, forming concrete. Mr. James Walker had used cement concrete very extensively in marine works at Dover, Alderney, and other places, with great success. The concrete used at the two former places was composed of Portland cement, mixed with shingle, in the proportions of one part of cement to ten parts of shingle, moulded into blocks varying from six to ten tons in weight.

The general dimensions of that part of the breakwater so constructed, were,—medium width, 90 feet, composed of a hearting of cement concrete blocks, 60 feet in breadth, protected by range work of blocks of Roach Portland stone, faced with granite, of an average thickness of 15 feet on each side. The foundation of the wall was 45 feet below low-water of spring tides, and the top rose to 20 feet above that mark, making a total height of 65 feet.

It had been observed, that the quality of the Portland cement was not always uniform, and that expansion, or disintegration of the blocks had taken place two or three months after they were made, and before they were bedded in position, which operation was generally delayed for six or nine months, to allow them to become thoroughly dry. The manufacture of Portland cement was evidently one which required much care, and was not free from risk, though its general employment was satisfactory, and its use was daily extending for all works of civil engineering and architecture.

To this it was replied, that the cases of expansion which had been noticed, probably arose from the presence of too much lime in the cement—the result of careless or improper manufacture; but such results had not been observed in cement supplied by good manufacturers. The lime so found in a free state, and not well incorporated with the other ingredients, would undergo the action of slaking by the atmosphere, and still more rapidly by sea water, and disintegration would ensue. The manufacture of this cement was essentially one of confidence, and such defects as those mentioned, rarely, if ever, occurred with the produce of experienced manufacturers.

With regard to the works at Dover, it was stated, that though nearly half-a-million cubic feet of concrete, in blocks, were now laid annually, the proportion of breakage scarcely exceeded one per cent.

The cost of the concrete blocks was assumed to be about one-half of the cost of the stone walls which had originally been intended to have been constructed. The large cubic contents and consequent weight of these blocks, the uniformity of their size, and their close contact in the work, were relied on as prominent advantages in their use.

The French engineers had used concrete blocks, made of lime and artificial pozzolana, at Marseilles, Rochefort, Algiers, and Cherbourg. After a few years' exposure to the sea water, these blocks had disintegrated and fallen to pieces; a result ascribed by M. Vicat to the presence of magnesia in the sea water, which acted injuriously on the lime. It was not without hesitation, therefore, that some years later they had commenced the employment of Portland cement for their béton works; but the results ascertained in the interval, as to its durability, when exposed to the action of sea water, appeared to have justified the present general adoption of that material, even to the extent of using the blocks in external walls, without the protection of stone casing.

The injection of Portland cement into the foundations of the Pont de l'Alma, was noticed as a method of forming béton under water, which, though allowable in exceptional cases, could not be recommended on the score of economy; as in the case in question, a quantity of cement, costing not less than £1500, had been employed, one-third of which had, in all probability, been washed away by the current, and had never set at all.

At Alderney, the depth of water was greater than at Dover, and there was abundance of stone, which was thrown in as "*pierre perdu*" to form the substratum; and from a depth of 12 feet below low water, a vertical stone wall was brought up, backed by concrete blocks, to form the hearting.

Descriptions were given of the large blocks of concrete used at the

new harbour works at Marseilles and at Algiers. They weighed upwards of 50 tons each, and were moulded close to the spot where they were to be used, and then thrown into the sea. At Algiers, it was believed that considerable disintegration had taken place, as it was evident that large cavities existed in the work. When the sea was agitated, it was scarcely possible to walk on the mole, on account of the jets of water which were driven through the apertures, with great velocity, to considerable distances. The local engineers anticipated that these cavities would in time be closed by the accretions of shells, by which several had been already stopped; but this presumed that the disintegration of the blocks was not also progressing. It was questioned whether this disintegration had not arisen from the use of artificial instead of natural pozzolana.

The extensive use of concrete by the ancients was noticed, and the magnificent works in Rome were quoted as instances of its durability. There it had been used for vaulting, by first constructing ribs of tiles and pozzolana cement, and filling in with concrete. The excellent quality of the natural material, which abounded near Rome, had, no doubt, contributed to its general and successful employment.

The paper read was, "*A description of the method of building bridges upon brick cylinders, in India*,"—by Mr. G. B. Bruce, M. Inst., C.E.

The author began by adverting, generally, to the constitution of Indian railways, as joint-stock undertakings, having a certain rate of interest guaranteed to them by the East India Company; in return for which, the railway companies were constrained to submit to a degree of government control and interference, which militated very much against the speedy and judicious execution of the works.

The paper next referred to the Madras railway, in particular, which had the city of Madras as its terminus on one side of the Peninsula, and Beypoor, near Calicut, on the other, and extending over a length of 450 miles.

Eighty miles of this line had been opened for traffic, and the remainder was under construction. All had been executed by the railway company's own engineers, a system which, the author stated, had been found to answer exceedingly well.

The bridge to which this paper was specially appropriated, was built over the river Poiney, about seventy miles from Madras, and consisted of fifty-six arches, each of 30 feet span, a small-sized arch being best suited to the powers of the native workmen, and the character of the site of the bridge itself. The bed of the river being of sand, to an unknown depth, it was necessary to resort to some description of artificial foundation, and in England the probable expedient would have been timber piling; but in Madras the expense of timber precluded its use in that way, and the usual native expedient of brick cylinders was resorted to.

Each pier was founded upon fourteen cylinders built of radiated bricks, of two feet six inches internal, and five feet external diameter, sunk to a depth of 15 feet below the bed of the river, and filled with

broken stone and bricks. Besides the cylinders, immediately under the piers, there were two rows of cylinders stretching the entire length of the bridge; one under each of the inverts, to protect them against the effect of any scour through the arches; forming, as it were, two brick walls across the stream, founded at 15 feet below the bed of the river.

The cylinders were placed as closely together as possible, and the interstices between them filled up with broken stone, to as great a depth as it could conveniently be placed. The masonry was commenced at a depth of five feet below the bed of the river, on the top of the cylinders; this, it was believed, would prove sufficient precaution against the effects of the stream. Should there, however, be any tendency to undermine the foundations, this could be guarded against by throwing in an apron of rubble-stone, on the down stream side of the bridge.

The masonry was of gneiss rock, found in the neighbourhood, and quarried by the application of fire, which caused it to split off in regular layers, varying in thickness from three inches to one foot. The total cost of the bridge was about £14,000, or £7 per lineal foot.

The author, in conclusion, observed, that the system of building on brick cylinders was similar in principle to that sometimes pursued in this country, where piers were built on large cast-iron cylinders; which, from the difficulty of procuring them, and their greatly increased cost, were not so well adapted for public works in India, and it was doubted whether any plans could be devised, which, for efficiency, readiness of execution, and economy, would be so well suited to the purpose as the brick cylinders of India.

Attention was directed to a paper by Captain (now Colonel) Goodwyn, B.E., read before the Institution in February, 1842, giving an account of a very similar method of obtaining foundations in Bengal. His description was, "As soon as the masonry (of the cylinder) has hardened sufficiently, the well-sinker fixes a plumb-line to the top of the cylinder, as a guide, and descends withinside, carrying an instrument called a 'Phaora' or 'Mamooti,' somewhat similar in shape to a hoe: with this he excavates the earth until the water is too deep: he then commences the use of the 'Jham,' which resembles the 'Phaora' in shape, but is about 36 inches long, and 27 inches wide, and is suspended to a cord passing over a pulley above the cylinder. Upon this instrument the well-sinker descends, and, diving into the water, excavates with the 'Jham' the soft earth under the sides of the curb, and is at intervals drawn up with the instrument. The cylinder descends gradually from 6 inches to 2½ feet per day, as the earth is withdrawn from beneath it, and relays of workmen keep it constantly going, lest the sand should settle around it and cause it to hang up."

This process appeared to differ somewhat from that employed at Madras, and the wells were different in Bengal, inasmuch as they appeared to be coved over, and the weight of the superstructure was thus thrown upon the outer walls of the cylinders; whereas, in Madras, the wells were filled up with material which rendered the whole a solid mass.

The improvements introduced by Colonel Colvin, of forming square or elongated masses of brickwork, with several wells in each, had been further extended by Colonel Sir Proby Cautley, who had made each

mass of the full size of the foundation of the structure to be placed in it: in this way he established the piers of the great Solani aqueduct on the Ganges canal. Some engineers filled in the wells with loose rubble, with the object of providing for any sinking away of the sand from beneath the cylinders, which frequently occurred, as the foundations were placed on the sandy beds of rivers, which were dry in certain seasons, but became torrents at other periods. Depths of 20 to 30 feet of sand were not unfrequently washed away, and it had been therefore necessary in some instances to carry these wells down as deep as 40 feet.

These wells acted in a double capacity,—as piles holding by lateral friction, and as forming a mass under the building. The system was not universally applicable; for instance, in a river constantly full of water there would be considerable difficulty in using it; in fact, other systems would probably be cheaper. The Indian rivers, which were generally dry for a large portion of the year, could not be traversed by any other system so expeditiously or so economically, nor the works be otherwise rendered so permanent.

May 19th, 1857.

The paper read was "*On the disturbances of suspension bridges, and the modes of counteracting them,*"—by Messrs. A. S. Lukin and C. E. Conder.

This paper brought under consideration the various kinds of suspension bridges, and examined their greater or less liability to undulations of the roadway, and other disturbances occasioned by a traversing load, or other causes.

These disturbances were attributed, chiefly, to the flexibility of the chains, and were enumerated as follows:—

1. Undulations caused by traversing loads.
2. Reaction on the roadway of the chains when set in agitation.
3. Transverse swing.
4. Distortions caused by the gravitating tendency of the chains.
5. The effect of unequal loading in bridges of multiple spans.

The first class of disturbances might be reduced by increasing the mass of the chains. The objection to this was that not only would such an expedient prove wasteful of material, but the greater the weight of the chains, the greater the danger of their destroying the platform, if once set in agitation. Again, the roadway might be supported by a rigid girder, strong enough to withstand any distortion of the chains. Such a girder would, however, be nearly strong enough to carry the load independently of the chains, which would become dangerous auxiliaries to an inflexible platform.

The Niagara Suspension Bridge was adverted to, as having its liability to undulate much reduced, not only by connecting the upper and lower platforms with lattice trussing, but also by employing strong upper and under bracing rods.

It was contended, that while a certain degree of stiffness in the platform would be advantageous, as equalising the distribution of the load

on the chains, the main point for inquiry must be the arrangement of chains and rods best calculated to abate the liability to disturbance.

With this view, six modes of arrangement were described and illustrated, viz.:—

1. The ordinary suspension bridge.
2. The mode of suspension by a double set of crossed chains (Russell's).
3. The single rod direct suspension.
4. The chain with slanting rods (Dredge's).
5. The double rod direct suspension.
6. A new mode, distinguished as the convergent suspension, of which two varieties were exhibited and explained, by means of diagrams and models.

1. It was pointed out, that while the ordinary form of suspension bridge effected a marked economy of material, its great flexibility and liability to undulate and swing operated against its employment for railway traffic.

2. The mode of suspension by crossed chains (as in Mr. Russell's bridge), while tending in some degree to reduce these disadvantages, required an enormous increase of material, together with a double height of tower.

3. It was stated, that the single rod direct suspension, while perfect in theory, as regarded freedom from undulation, was defective, owing to the length required for the rods, the sharp angles at which they met the roadway, and their consequent liability to stretch and "sag."

4. The introduction of a chain to support the slanting rods (as in Mr. Dredge's bridge,) diminished these evils and shortened the rods, at the same time that it secured a more equable distribution of the tensions. But this arrangement, in common with the preceding mode of direct suspension, imposed powerful horizontal strains on the roadway; and the excessive strength, thus demanded in the platform, militated against economy, if it did not even impair the safety of the whole structure.

5. The double rod direct suspension entirely relieved the platform from any horizontal strain; but the great length and angle of its extreme rods entailed and increased all the other evils to which the single rod direct method was exposed.

6. The convergent mode of suspension was devised to avoid, as far as practicable, the several defects which had been pointed out in the five arrangements above mentioned. From a double set of chains (each extending from the top of one tower to the platform level at the opposite extremity), a double set of rods were suspended, slanting in opposite directions, so that a pair of rods converged to every point by which the platform was suspended. There was thus an entire absence of horizontal strain on the roadway, which might, therefore, be made of extreme lightness; while the advantages of direct suspension would be to a great extent secured, the undulations of the roadway and the tendency to lateral swing being reduced to a minimum; and the reaction of the chains on the platform would be much diminished by the radiating play of the rods. It was shewn, by means of tables, that the convergent principle admitted considerable economy of material. Two designs were exhibited, the second of which, although theoretically inferior to the

first, effected a great saving in the weight of the chains, by allowing a sharper curvature. At the same time, it was submitted, as a matter worthy of inquiry, whether an application of the convergent method might not be arrived at still better suited for large spans.

A mode was suggested of connecting each pair of rods with the platform, by means of a self-adjusting lever, the play of which, by equalising the horizontal strains, would tend to diminish the derangements caused by an unequally distributed load.

It was pointed out, that the gravitating tendency of the chains would cease to operate, as a source of disturbance, if their sectional weight were so adjusted (by ballasting or other means) as to cause them to hang naturally in the curves due to the conditions of suspension.

The effect of unequal loading in bridges of multiple spans was then adverted to, as giving rise to danger, through the unequal tensions induced in the chains on opposite sides of a tower. A table was given, shewing that the employment of convergent rods reduced this danger to some extent. Inverted chains below the platform were also advocated in bridges of multiple spans designed for railway traffic.

May 26th.

The President's Annual *Conversazione* was held on this evening, when a collection of models and specimens of works of art were exhibited; and with this meeting terminated the session of the society.

INSTITUTION OF MECHANICAL ENGINEERS.

The following paper, by Mr. John Downie, of Glasgow, was next read,—"*Description of an iron construction of foundry, and an improved process of moulding pipes and hollow-cast ware.*"

The subject of the present paper is an improved application of iron to structural purposes, where great lateral strains, such as are occasioned by the action of powerful lifting cranes, have to be resisted; which has been carried out in the construction of the North Woodside Iron Works, erected by the writer in 1852.

The foundry is constructed wholly of iron, with the exception of the horizontal timber framing for the tops of the cranes. The separate parts of which it is composed are arranged and united together in such a manner as to resist lateral strains in all directions, and the thrust of the cranes is carried down to the ground by a series of sloping struts at the sides and ends of the foundry.

The columns support longitudinal girders, the ends of which form sockets to receive the ends of transverse timbers. The longitudinal girders are connected outside to struts by a dovetail joint and bolts, and the struts thus serve to bind the girders together while they receive the pull or thrust of the strains to which the building is subjected. The foundations for the columns and struts are cubes of brickwork, well grouted and bound together with top and bottom plates and tie-bolts, the earth around them being well rammed and secured. By this arrangement the heavy strains

of the cranes are carried down into the ground and distributed over a large area, giving great stability and strength with very little proportionate expenditure of material.

The columns are cast with a snug or projecting piece on the top, in the shape of a T head, which forms a strong connection between the longitudinal girders and the column, and locks them securely together. The flanges on each girder form a socket to receive the ends of the transverse timbers, and the outer corners receive the ends of diagonal pieces. The girders are bolted together by a cross bolt through the transverse beam, and the latter is secured to the top of the column by a vertical bolt. The under side of the beam is notched out to fit upon the head of the snug, which thus serves as a tenon to take the strain off the cross bolt when the beam is subjected to a pull. The struts are cast with a dovetail jaw at the upper end, which grasps corresponding dovetail pieces cast on each end of the longitudinal girders: the dovetail joint serves to bind the girders together, and also takes the pull of the cranes down to the foundations. The thrust is received by the struts by means of a bevilled flange; and the struts, girders, and columns are thus united firmly and securely, in such a manner as to offer an effective resistance to all the strains occasioned by the work of the foundry. The upper roof is entirely independent of the rest of the frame-work of the foundry, and takes no part of the strains. The main principals rest on the top of the transverse timbers, immediately over the columns, and abut against the girders; so that the thrust is received by the struts and thrown upon the foundations in the ground, thus obviating the necessity for tie rods to prevent spreading.

The work of the foundry is carried on by means of a set of swing cranes, the larger of which are in the centre of the foundry, and the smaller fixed to the side columns. The large cranes are supported at the top by a step or socket fixed on the transverse timbers, consisting of a bearing cast with sockets on the upper side to receive the longitudinal and diagonal timbers. Similar socket pieces are employed at the intermediate junctions of the longitudinal and tranverse timbers. In this arrangement accordingly the longitudinal and diagonal beams are supported in their entire depth by the tranverse beams, and a good abutment is obtained for the ends in the sockets, instead of the ordinary method of slightly notching the longitudinal timbers on the transverse ones, and then bolting them together. The smaller cranes are principally derrick cranes, working about the alternate columns of the foundry.

The distance between the columns and roof principals is twenty-one feet, and the width between the two rows of columns forty-two feet, with a clear height of twenty-one feet under the transverse beams. By taking advantage of the sloping struts to form side lean-to roofs, an increased width of foundry is obtained, bounded by dwarf side walls at which the roofing terminates: an uninterrupted floor space of eighty-four feet total width between the dwarf side walls is thereby left available, a desideratum of much importance in such arrangements.

The upper roofing consists of sheets of corrugated iron, supported on iron purlins carried by the roof principals. Ample ventilation is secured at the eaves through the girders, which are cast with a series of openings for the purpose; and also by the top opening running the entire length of the roof, and the openings left at the overlap of the roof sheets. The foundry is lighted entirely from the side roofs with Hartley's rough sheet

glass, fixed in metal sash bars which rest on purlins carried by the struts: the skylight runs nearly the whole length of the roof, so as to give a flood of light direct upon the moulding floor.

Since the erection of the works in 1852, this construction of foundry has been found to meet all requirements of resistance and strength, without any apparent giving in any of its parts; although during the period that has since elapsed, it has been subjected occasionally to strains of between 45 and 50 tons on the cranes; and the result has thus proved satisfactorily that iron may be successfully applied, in preference to any materials, in other erections where great strength and power of resistance are required.

The further subject of the present paper is a description of an improved process adopted by the writer for moulding pipes and hollow cast ware, and applicable to a wide range of articles, such as cast-iron socket pipes for gas or water, rain water conducting pipes, camp ovens, kettles, three-legged pots, shot, shell, guns, mortars, and articles generally of cylindrical or spherical form.

The internal pattern is made separately in core boxes, or otherwise in the ordinary manner; but the pattern for producing the external portions of the mould is fitted with a cam, in the form of a collar, resting upon adjustable bearings in the frame-work of the table on which the moulding flasks are rammed: a portion of the cam is concentric with the axis of the pattern, and the remainder excentric, so as to elevate the pattern between the two edges of the moulding table, and withdraw it again accurately by lowering.

The moulding table has the two edges of its face shaped so as exactly to fit the pattern when the latter is raised with its axle level with the edges. The pattern is fitted with a cam or collar at each end, of which a small portion is concentric with the axis of the pattern, and the remainder excentric. This cam rests upon an adjustable bearing, and the axle of the pattern is guided by vertical slots in the ends of the moulding table. On causing the pattern to rotate, the excentric portion of the cam acting on the bearing, gradually raises the pattern to its highest position, when its centre line will be level with the edges of the moulding table. The flask is then placed on the table, and rammed up to form one half of the mould. The farther rotation of the pattern upon the concentric portion of the cam retains it in contact with the mould, and thus sleeks, smoothes, or finishes the mould, until the excentric portion comes round, when the pattern is gradually withdrawn: the flask may then be removed without danger of injury to the parting or junction surface, ready for closing and casting in the usual manner.

The same principle has been adopted also for making the cores or internal moulds, by employing a core barrel made in three portions, two of which are hinged upon the third. The centre spindle is fitted with cams of the form above described, which act upon a V-piece inserted between the two free edges of the core barrel. By turning the centre spindle, the V-piece is pushed out, or drawn in, thereby expanding the core barrel, or contracting it as required: by this means the use of straw or hay, in core making, is dispensed with.

By applying this method to moulding three-legged pots, and other articles of that description, when the several pieces of the mould are put together, "cheeks," such as are commonly required in the ordinary plans

of moulding such articles, for protecting the partings of the moulds, are by the present plan entirely dispensed with, and the ugly scar left by them on the casting is avoided; and instead of the flasks being required in four pieces to form the mould, three are sufficient—the external mould being made in two halves, with plugs inserted for the legs. Consequently, several sizes of pots may be made with the same sized flasks; and while the plant is otherwise simplified and reduced in cost, increased efficiency is obtained, since by this arrangement little or no discretionary power is left in the hands of the workman.

Scientific Adjudication.

COURT OF QUEEN'S BENCH, WESTMINSTER.

May 28th, 1857.

Before Lord Campbell, Mr. Justice Coleridge, Mr. Justice Erle, and Mr. Justice Crompton.

BOVILL *v.* KEYWORTH.

This was an application to set aside the verdict of the jury, given in favor of the plaintiffs at a trial at law, which took place on the 4th and 5th of July, 1856, for damages for the infringement of plaintiff's patent.* During the trial, some objections were taken to the ruling of the presiding judge (Lord Campbell) as to the construction of certain parts of the specification; and these points were reserved for the consideration of the Court. The case having been argued by counsel for and against the objection, the Court now pronounced judgment:—

JUDGMENT.

Lord Campbell.—We are of opinion that the objections to the validity of the patent cannot be supported. The whole of the plaintiff's process, if the combination be used, is certainly the subject of a patent, and so would the part numbered 2, if taken separately, for exhausting air in the cases of mill-stones, combined with the application of a blast to the grinding surface, as they introduce very important improvements in the manufacture of wheat and other grain into flour. The combination of the exhaust and the blast, so as to carry off the warm dusty air blown through between the stones to a chamber above, while the pure flour, in a dry condition, descends into the chamber below, added to the quantity and improved the quality of the flour produced in grinding, and its effect was highly favorable to the health and comfort of the men employed in the operation: still, if the specification does not point out the mode in which this part of the process No. 2, is to be conducted, so as to accomplish the object in view, it would be a statement of a principle only, and the patent would be invalid. But we are of opinion that the specification, on the face of it, cannot, as contended, be pronounced,

* For report of this trial, see Lond. Jour., Vol. iv., p. 108, New Series.

in point of law, to be bad in this respect; and we are of opinion that the evidence adduced at the trial shews it to be quite sufficient. The specification says,—"In carrying out the second part of my invention, when working mill-stones with a blast of air, I introduce a pipe to the mill-stone case from a fan or other exhausting machine, so as to carry off all the warm dusty air blown through between the stones, to the chamber, as hereinafter described; and this part of my invention relates only to sucking away the plenum of dusty air forced through the stones, and not to employing a sufficient exhausting power to induce a current of air between the mill-stones without a blast." That is the language of the specification. The exhaust produced by the pipe and fan in the patent is to be proportioned to the plenum caused by the blast—taking care not to produce an inconvenient current of air, against which a caution is given. How can a Judge take on himself to say that this may not be enough to enable a workman of competent skill to construct the machinery? According to the evidence the specification was abundantly sufficient for this purpose; and therefore it could no more be necessary to the specification to explain the details by which the pipe and fan were to be employed to create and to regulate the exhaust, than to describe how the mill-stone case or the stones themselves were to be fashioned. The learned counsel for the defendant being long familiarly acquainted with the manner in which this part of the process is conducted, being asked, during the argument, to suggest the fit language to be employed to instruct the workmen how to adjust the exhaust so as properly to suck away the plenum, that the stive may be discharged into the chamber above, was unable to devise any improvement on the specification; therefore, the plaintiff being now allowed to be the inventor, the jury being in our opinion fully justified in finding that the process had not been publicly practised at Glasgow before the date of the patent, and the specification being sufficient, the patent is valid; and we have only to consider whether there has been an actionable infringement of it by the defendant, so as to exhaust the blast in the manner described as No. 2, in the way in which the upper stone rotated and the nether stone was fixed. The plaintiff contends that his patent, as explained by his specification, was originally for four separate and independent inventions, and that No. 2, in the amended specification must be considered a separate and independent invention, as if the patent had been granted for this alone. The defendants contend, on the contrary, that the patent was granted for one process, comprising several successive and connected parts; the use of the fixed upper millstone being one of them. We do not think it necessary to try to reconcile the different parts of the specification, which are somewhat conflicting, or to give any positive opinion on the question; for supposing the patent to be for a combination consisting of several parts for one process, we are of opinion that the defendants are liable in this action, for having used a material part of the process, which was new, for the same purpose as that mentioned in the specification, although they did not at the same time use all the parts of the process as specified. The defendants admit that they used the part of the process numbered 2, as described in the amended specification, and they rest their defence on the fact that they did so only in a mill with a rotating upper stone; but the fixed upper stone was clearly described by the

plaintiff, with the statement and diagram to be found in his specification, as part of the combination for which he took out the patent. As No. 2, is a material part of the combination, and was new, we are of opinion that he cannot lawfully use No. 2, for the same purpose, by substituting a rotating upper mill-stone for a fixed upper mill-stone, or by resorting to any other equivalent for any other part of the separate process specified. This case seems to us to be governed by Lister *v.* Leather, and the authorities which in that case we fully commented on; and therefore, there ought to be judgment for the plaintiff.

May 28th, 1857.

DE LA RUE AND OTHERS *v.* DICKINSON AND OTHERS.

This was an application, on behalf of the defendants, to enter a verdict in their favor, in place of the adverse verdict given against them at a trial at law, which took place before Lord Campbell on the 13th and 14th days of February, 1847, for the alleged infringement of the plaintiff's patent;* the ground for the application being, that the patent in question was for certain specific arrangements of machinery having certain definite actions, and that no evidence had been adduced to shew that such mechanism or mechanical actions had been employed by the defendants. The case having been fully argued by the counsel on both sides, the Court now pronounced judgment:—

JUDGMENT.

Lord Campbell.—We are of opinion that the rule obtained by the defendants in this case ought to be discharged. It is admitted that the inventions for which the two patents sued upon were granted, were new and useful, and the only objection to the specifications is, that the claims in them are too wide and vague. The usual dilemma, however, is propounded, that upon this objection the patents are void, or that if the claims are construed to be within the limits, there has been no infringement of them by the defendants.

After carefully considering the specifications, we think that the claim in each is for the described means of conducting a useful process, resulting in a valuable manufacture, and that the specifications distinctly show what portions of those means are claimed as new, and what portions are allowed to be old. We therefore have only to determine whether the alleged infringement of them has been established. The defendants contend that there was no evidence of infringement to be left to the jury, and that the judge at the close of the plaintiffs' case was bound either to have directed a nonsuit, or to have ordered the verdict to be entered for the defendants, upon the plea of not guilty. We were told that evidence being given of what the defendants actually did, in the process alleged to be an infringement, it is always the province of a judge to say whether there has been an infringement or not; and that in the present case, the judge, without calling upon the defendants for

* For report of this trial, see Lond. Jour., Vol. v., p. 174, New Series.

any answer, ought to have determined by his own authority that there had been no infringement. We consider, however, that the doctrine contended for is contrary to principle, and would render it impossible to administer the law of patents, and is by no means to be deduced from Unwin *v.* Heath, or any of the other decisions referred to. There may well be a case where the judge may and ought to take upon himself to say that the plaintiff has offered no evidence to be left to the jury to prove an infringement, as if there were a patent for a chemical composition, and the evidence was that the defendant had constructed and used a machine for combing wool; but if the evidence has a tendency to shew that the defendant has used substantially the same things to attain the same result as specified by the plaintiff, and scientific witnesses have sworn that the defendant has actually used such means, the question becomes one of fact, or of fact mixed with law, which a judge is bound to submit to the jury. There can be no doubt that such evidence was adduced by the plaintiffs, both with respect to the patent of 1845, and the patent of 1849. The defendants therefore are confined to the contention that the verdict was against the evidence.

With respect to the patent of 1845, they are clearly so far right, when they insist that nothing which they did in their mode of conducting the process of making envelopes, prior to the stage of the process where they have got the flaps of the blank in a fit state for the second descent of the plunger to fold them—could be construed to be an infringement; for the plaintiffs have disclaimed the creasing accomplished by Addenbrooke's machine, and admit that the air jets must be considered a discovery which would be the subject of a patent. But at this stage, the plaintiffs' claim begins, and there was evidence of resemblance between the manner in which the plaintiffs and defendants completed the process and produced the perfect envelope; from which we are of opinion that the jury were justified in coming to the conclusion that the defendants' process was an imitation of, or substantially the same as, the plaintiffs. The folding of the flaps now commences, and the plaintiffs fold the flaps in succession, by folding instruments most ingeniously actuated by cams. The defendants likewise use folding instruments, inserted in the inverted box of the plunger; and the stroke of the descending plunger making those folding instruments or projections touch the different flaps in succession, folds them finally in the same manner, although not in the same order. Whether the two modes of folding by cams and plunger are essentially different or substantially the same, we think was a pure question of fact for the jury, and we cannot say that the jury were wrong in the conclusion at which they arrived. Great stress was laid by the defendants upon the fact that according to their process their was no contrivance for holding the flaps while the folding was going on; but we think the judge was right in telling the jury that there might be an infringement without a contrivance to hold the flaps, if without such a contrivance the two modes of folding were substantially the same.

The folding being a material part of the plaintiffs' process of manufacturing envelopes, it is not necessary to determine whether their claim extended to the rest of the process, and whether the two modes of the delivery of the perfect envelope, one above, the other below, be essentially different, or be substantially the same. But we would

observe that, generally speaking, as the manufacture which is the result of the process invented and patented is the ultimate object in view, the purpose of the patent laws is to protect all that is new in this process if it be described, although not expressly claimed.

With respect to the patent of 1849, for gumming the envelopes, the jury at the trial, after attentively examining the two models and seeing them work, expressed a clear opinion that the defendants' was a colorable imitation of the plaintiffs', and we think that this conclusion was fully warranted by the evidence. The great argument for the defendants was that they did not take the gum from an intermediary surface, and that their process of gumming could not be properly called "surface printing;" but we are of opinion that they might be guilty of an infringement without using an intermediary surface, and that without what is strictly called "surface printing," they might "apply gum to the flaps of envelopes" (these are the words of the plaintiffs' claim), "by operations acting in the same manner as surface printing, in contradistinction to the application of gum direct from a fountain containing the liquid."

For these reasons we think that the verdict ought not to be disturbed, and we pronounce judgment for the plaintiffs.

PROVISIONAL PROTECTIONS GRANTED.

[*Cases in which a Full Specification has been deposited.*]

1357. George Woodward Morse, of Louisiana, U.S.A., for an improved breech-loading fire-arm.—[*Dated May* 13*th.*]

1400. Charles Fréderic Vasserot, of Essex-street, for a typographical numbering apparatus,—being a communication.—[*Dated May* 19*th.*]

1419. George Sharp, of Jarrow, Durham, and William Elder, of the same place, for improvements in steam-hammers and machinery for forging iron and other substances.—[*Dated May* 20*th.*]

1612. John Gedge, of Wellington-street, Strand, for improvements in constructing gas retorts in the furnaces of steam-engines or other furnaces,—being a communication.

1617. Thomas Hale, of Massachusetts, U.S.A., for a new and useful or improved apparatus for heating and ventilating a building,—being a communication.

The above bear date June 9th.

1658. Thomas Turner, of Wolverhampton, for improvements in apparatus to be employed as an alarm and detector in cases of burglary.—[*Dated June* 12*th.*]

[*Cases in which a Provisional Specification has been deposited.*]

316. Julian Bernard, of the Albany, for improvements in fastenings for uniting wood, metal, cloth, leather, and other materials.—[*Dated February* 3*rd.*]

338. Henry Myers, of Rathbone-place, and Charles Askew, and John Askew, of Charles-street, Hampstead-road, for improvements in railway and other breaks and communicator between the guard and driver of railway carriages.—[*Dated February* 6*th.*]

778. Joseph François Maire, of Paris, for an improved cooking apparatus, producing a saving of fuel and time. [*Dated March* 20*th.*]

804. Bewicke Blackburn, of Clapham-common, for improvements in the manufacture of pens.—[*Dated March* 21*st.*]

874. John Horace Taylor, of Alma-street, Hoxton, for improvements in apparatus for regulating the flow of fluids applicable to water-closets and other similar purposes.—[*Dated March 30th.*]

946. Job Mead, and George Mead, both of Bethnal-green, for improvements in metallic and other packing-boxes or cases.

948. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture of hard India-rubber, being a communication.

950. John Henry Johnson, of Lincoln's-inn-fields, for improvements in steam-hammers,—being a communication.

952. John Penford Harvey, of Spalding, for improved machinery for crushing land or clods.

954. William Perks, jun., of Birmingham, for a new or improved manufacture of crown and sheet glass.

956. John James Rippon, of Oakenshaw Print Works, near Accrington, Lancashire, for an improvement or improvements in rollers or cylinders for printing fabrics.

The above bear date April 4th.

958. Bartholomew Predavalle, of Great Russell-street, for a new motive power.

960. Charles Burrell, of Thetford, for improvements in portable steam-engines suitable for agricultural purposes.

966. Charles Goodyear, of Leicester-square, for improvements in the manufacture of waterproof boots and shoes; applicable also in part to boots and shoes of other kinds, and to other outer coverings for the feet.

968. Louis Jean Marie Siblet, of Paris, for an improved pulp for the manufacture of paper.

The above bear date April 6th.

969. William Neville, of Jersey, for improvements in amalgamating certain substances for the production of fuel.

970. Ebenezer Rogers, of Abercarn, Monmouthshire, for improved methods of applying fuel for heating purposes.

971. John Rothwell, of Enfield, and Samuel Dixon Cooper, of Westminster, for improvements in breech-loading fire-arms.

972. James George Hunt, of Cincinnati, U.S.A., for improvements in fences and gates.

973. John Talbot Pitman, of Grace-church-street, for improvements in apparatus called fire-escapes,—being a communication.

974. George Pearson, of Oldham, and Edward Jessop, of Manchester, for improvements in sewing machines.

975. Henry Dearden, of Rochdale, for certain improvements in power looms for weaving.

976. John Robinson, of Glossop, for an improved apparatus for driving or giving motion to power looms; which said improvement is also applicable to driving other machinery.

977. Edward Finch, of Bridge Works, Chepstow, for an improvement in railway breaks.

978. Charles Cochrane, of the Ormesby Iron Works, Middlebro'-on-Tees, for an improvement in the heating of the blast for blast furnaces.

979. William Sullivan Gale, of New York, for improved means for rendering the joints of engines or other machinery steam or fluid tight.

980. Henry Brierly, of Chorley, Lancashire, for improved mules or machinery to be used in spinning.

981. Frederick Piercy, & Samuel Flagg, both of Belgrave-street, Argyle-square, for a portable expanding life and military boat, which is also adapted for other purposes.

The above bear date April 7th.

982. Barnabas Taylor, of Cranbrook, Kent, for an improved arrangement of combined bed and utensil for the use of invalids.

984. Robert Kanzow Bowley, of Charing-cross, for certain improvements in boots and other similar coverings for the feet.

985. Benjamin Hingley, and Samuel Hingley, both of Cradley, Worcestershire, for improvements in anchors.

986. Martin Billing, of Birmingham, for an improvement or improvements in the manufacture of metallic cornice ends.

987. James Bird Sparke, and Alfred Sparke, of the Thorne-lane Foundry, Norwich, for improvements in sawing machinery.

988. Alfred Francis, of Encomb-terrace,

Wandsworth-road, for improvements in fastening shutters and doors.

989. Edmund Edwards, and Edward Beacher, both of the Thorncliffe and Chapeltown Iron Works, near Sheffield, for improvements in machinery or apparatus for washing or cleansing mineral and other substances.

990. Charles Tilston Bright, of The Cedars, Harrow Weald, for improvements in laying down submarine telegraph cables, and in apparatuses to be employed therein.

991. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for cultivating land,—being a communication.

992. Jasper Wheeler Rogers, of Peat House, Roberts Town, Kildare, for improved means of, and apparatus for, collecting for use the excrement of towns and villages, and for facilitating the drainage of houses generally.

993. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for manufacturing coiled springs,—being a communication.

994. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in hand bullet-moulds,—being a communication.

995. Donald Bethune, of Cambridge-terrace, Hyde-park, for improvements in apparatus for preventing or consuming smoke in chimnies and furnaces.

The above bear date April 8th.

996. Edgar Brooks, of Birmingham, for improvements in the manufacture of fire-arms.

997. John Harland, of Newcastle-upon-Tyne, for purifying plastic clay used for the making of all kinds of earthenware, and for the cheaper and more expeditious manufacture of bricks, tiles, draining pipes, and other articles of clay of a similar nature or description.

998. William Oxley, and Hugh Strath, both of Manchester, for improvements in lubricators.

999. John Atherton Molineaux, of Brighton, for improvements in economising heat in locomotive and other high-pressure steam-engines.

1000. Thomas Rolfe, of Regent-street, for improvements in piano-fortes.

1001. Augustus Frederick Kynaston, of Plymouth, for securing and disconnecting ships' boats and towing-cables.

1002. Henry Thompson, and Henry Walmsley, both of Great Harwood, near Blackburn, Lancashire, for improvements in looms for weaving.

1003. Edwin Powley Alexander, of Lincoln's-inn-fields, for improvements in the manufacture of fulminating powder,—being a communication.

1004. Charles Frederick Bielefeld, of Wellington-street, Strand, for improvements in preparing the surfaces of slabs or sheets made of fibrous and cementing materials.

1005. Joseph Purnell, of John-street West, Barnsbury, for improvements in apparatus for taking photographic pictures.

1006. George Edward Taylor, of Oatlands Mill, Leeds, for an improvement in raising and shearing cloths.

1007. William Clark, of Chancery-lane, for an improved instrument for indicating the pressure of steam,—being a communication.

1008. Robert Turnbull, of Harwich, for improvements in slips or ways for heaving up and moving ships, and in cradles for the same.

1009. William Armitage, and Henry Lea, both of Farnley, near Leeds, for certain improvements in the manufacture of iron.

1010. John Leach, of Over Darwen, Lancashire, for improvements in looms for weaving.

1011. John Beech, of Shrewsbury, and John Williams, of Wellington, both in Salop, for an improved mode of securing the rails of railways in their chairs.

1012. John Coope Haddan, of Cannon-row, Westminster, for improvements in the manufacture of, and in the means of, and apparatus for, discharging projectiles.

1013. John Coope Haddan, of Cannon-row, Westminster, for an improvement or improvements in the smelting and refining of iron,—being a communication.

The above bear date April 9th.

1015. Charles J. Bunker, of New York, for an improved life preserver, or life preserving shirt or sack.

1016. William Smith, of Salisbury-street, Adelphi, for a universal Jacquard apparatus,—being a communication.

1017. James Marrow, of Sheerness, for improvements in machinery or apparatus for manufacturing bolts, rivets, nuts, and other similar forgings.

1018. Charles Smith, of Holloway, for an apparatus to be used in connection with certain domestic utensils.

1019. John Matthews, of Hurcott Mill, near Kidderminster, for a new or improved vat, to be used in the manufacture of paper.

1020. Henry Félix Courenq, of Toulouse, for improvements in machinery for ruling paper.

1021. Sebastien Didier L'heritier, of Paris, for certain improvements in signals.

1022. John Blythe Robinson, of Beverley, Yorkshire, for improvements in machinery or apparatus for effecting agricultural operations,—being a communication.

1023. Joseph England, of Beverley, Yorkshire, for improvements in machinery for washing and wringing woven fabrics and similar articles.

1024. Richard Archibald Brooman, of Fleet-street, for improvements in the distillation and rectification of spirits, in apparatuses employed therein, and in the preparation of the substances to be distilled,—being a communication.

1025. François Desir Lejard, of Paris, for an improved safety apparatus to be applied to the triggers of fire-arms.

1026. William Gresham Wiles, of Lady's Well Brewery, Cork, for improvements in brewing.

1027. Thomas Wilton, and John Huggett, both of Eastbourne, Sussex, for an apparatus for regulating the flow or supply of gas.

1028. Thomas Nathaniel Pengelly, of Gloucester-street, Commercial-road, East, and George Porter, of Mary Ann-terrace, Bethnal-green-road, for improvements in the application of steam to lifting or hoisting coals and other goods from ships' holds.

1029. Charles Sydney Johns, of Barnard's Inn, Holborn, for improvements in preparing pulp for the manufacture of paper.

1030. Thomas Robert Winder, of Dover, for an improved mode of constructing submarine works.

1031. Josiah Gimson, of Leicester, for improved apparatus for preventing the explosion of steam boilers.

1032. Henry Adcock, of the City-road, for improvements in steam-boilers.

The above bear date April 11th.

1033. Jean Baptiste Pascal, of Lyons, for improvements in electric lamps.

1034. Thomas John Searle, of Portland wharf, Wapping-wall, for improvements in fastenings for window sashes.

1035. Joseph Maurice, of Regent-street, for certain improvements in the fastenings, fixings, and attachments used for supporting or securing artificial teeth in the mouth.

1036. Thomas Richardson, & Edmund John Jasper Browell, of Neville Hall, Newcastle-on-Tyne, for improvements in treating old or waste railway wood, sleepers, and bearers, and in preparing or preserving wood for railway sleepers and bearers, and other works.

1037. Joseph and Edmund Ratcliff, of Birmingham, for an improved mode or modes of adjusting chandeliers.

1038. Charles Goodyear, of Leicester-square, for improvements in the manufacture of life-preserving apparel and other buoyant pliant articles.

1039. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the construction of boats, buoys, floats, or other buoyant vessels,—being a communication.

1040. Augustus Edward Schmersahl, of Miles Platting, Lancashire, for improvements in treating bones for the purpose of obtaining gelatine, size, or glue, and in obtaining certain useful products from such treatment.

1041. Daniel Reading, of Claverdon, Warwickshire, for an apparatus for ventilating and increasing the draft in fire-places and flues.

1042. Richard Archibald Brooman, of Fleet-street, for a method of, and apparatus for, disinfecting alcohol, or for separating essential oils therefrom, —being a communication.

1043. Pierre Victor Beaumesnil and Charles Erhard, of Paris, for a new and improved system of wheels for railway and other carriages.

1044. Thomas Greville Potter, of New Oxford-street, for an apparatus for day and night advertising.

1045. Charles Barlow, of Chancery-lane, for consuming the smoke and gases of furnaces, and at the same time furnishing a hot air blast; being a smoke and gas consuming hot air blast furnace,—being a communication.

1046. Patrick Mc Farlane, of Comrie, Perthshire, N.B., for improvements in looms for weaving.

1047. John Ramsbottom, of Longsight, near Manchester, for improvements in wrought-iron railway chairs, and in machinery for manufacturing the same and other articles.

The above bear date April 13*th.*

1048. Robert Hazard, of Thanet-place, Strand, for an improved heat extractor.

1049. Peter Wicks, and Thomas Gouldston Ghislin, both of the Cape of Good Hope, for superseding the use of bristles, cocoa fibres, flax, hemp, whalebone, &c., to be styled and called an invention for adapting and applying the fibrous plants of South Africa for the purposes of manufacture.

1050. Charles Jean Marie Lavigne, of Paris, for improvements in machines or apparatus for swinging, see-sawing, revolving, and for performing other exercises or amusements in the air.

1051. John Rubery, of Birmingham, for improvements in the manufacture of umbrella and parasol ribs.

1052. Thomas Harrison, of Nebthwait Mills, Lancashire, for new or improved machinery for the manufacture of wooden pill-boxes, match-boxes, and other such like articles.

1053. Richard Archibald Brooman, of Fleet-street, for improvements in machinery for mixing, solidifying, pressing, and moulding,—being a communication.

1054. Benjamin O'Neale Stratford, Earl of Aldborough, of Stratford Lodge, Wicklow, Ireland, for improvements in aerial navigation, and in the apparatus connected therewith, parts of which are applicable to locomotion generally.

1055. Robert Knowles, of Manchester, for certain improvements in machinery or apparatus for winding yarn.

1056. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for generating and superheating steam,—being a communication.

1057. John Henry Johnson, of Lincoln's-inn-fields, for improvements in machinery or apparatus for raising and forcing of fluids,—being a communication.

1058. John Henry Johnson, of Lincoln's-inn-fields, for improvements in fire-arms,—being a communication.

1059. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in carding engines, —being a communication.

1060. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved means of lighting gas for illuminating and other purposes,—being a communication.

1061. Henry Willis, of Manchester-street, Gray's-inn-road, for improved machinery for supplying air to organs and free-reed instruments.

The above bear date April 14*th.*

1062. Robert Knowles, of Manchester, for certain improvements in power looms for weaving.

1063. John Coutts, of Willington Lodge, Northumberland, for an improved method of uniting together the parts of all kinds of floating bodies composed of metallic substances, as well as vessels for containing fluids, gases, &c.

1064. Louis Barnett, of New-street, Bishopsgate, for improvements in the making and cutting out of garments.

1065. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved apparatus for taking the measurements for coats and other garments,—being a communication.

1066. Charles Goodyear, jun., of Leicester-square, for an improved manufacture of paper knife.

1067. Bonnet Frederick Brunel, of Hampstead-road, for improvements in raising sunken vessels and other submerged structures and articles, and in machinery and apparatus employed therein.

1068. James Payne, of Kirkcudbright, N.B., for improvements in scythes.

1069. Thomas Richardson, of Newcastle-on-Tyne, and Manning Prentice, of Stowmarket, for improvements in the manufacture of manure.

1070. Jacob Safran, of Wellclose-square for improvements in locking or fastening combinations of drawers in chests, tables, nests, or otherwise.

1071. Jean Baptiste Leuillet, of Paris, for improvements in binding account and other books.

The above bear date April 15th.

1072. John Sudbury, and Alfred William Linsell, of Halstead, Essex, for an improved gas regulator.

1073. George Raggett, of Duke-street, St. James's, for improvements in railway breaks and carriages,—being a communication.

1074. Thomas and Frederick Sugden, of Oldham, Lancashire, for improvements in sewing-machines.

1075. Samuel Thomas Crook, of Halifax, for improvements in the mode or method of manufacturing iron retorts, safes, cisterns, ovens, boilers, chests, and other similar articles of iron manufacture.

1076. William Weild, of Manchester, for improved arrangements for printing, dyeing, coloring, or staining and otherwise preparing yarns or threads for various manufacturing purposes.

1077. Robert Hindle, of Sabden, Lancashire, for improvements in that apparatus used in calico and other printing known as the sieve.

1078. Thomas Layzell Scowen, of Allen road, Stoke Newington, for the horizontal fin-expanding-canopy for carriages, boats, and places.

1079. Isaac Sherwood, and Joseph Blount Wayne, both of Birmingham, for improvements in certain apparatus to be attached to vehicles for the purpose of acting as a check upon the drivers or conductors of such vehicles, by indicating the number of passengers carried and the distance each has travelled.

1080. James Warburton, of Addingham, near Otley, Yorkshire, for improvements in preparing and combing wool and other fibres.

1081. Johnson Hands, of Epsom, Surrey, for improvements in kilns and in furnaces and flues, for withdrawing air and vapours from drying and other chambers.

1082. James Warburton, of Addingham, near Otley, Yorkshire, for improvements in carding machinery.

1083. Samuel Newington, of Ridgeway, Ticehurst, Sussex, for improvements in structures for growing grapes and other fruit.

1084. James Warburton, of Addingham, near Otley, Yorkshire, for improvements in preparing and combing wool and other fibres.

1085. William Smith, of Salisbury-street, Adelphi, for a smoke-consuming furnace,—being a communication.

1086. Peter Armand, Le Comte de Fontainemoreau, of South-street, for an improved truck apparatus for moving and transporting stones and other heavy bodies,—being a communication.

1087. George Schaub, of Birmingham, for a new or improved manufacture of types for printing.

The above bear date April 16th.

1088. Edward Oldfield, of the Adelphi Iron Works, Salford, for improvements in self-acting mules for spinning and doubling,—being partly a communication.

1089. Samuel Messenger, of Hatton Garden, and Theödore Fletcher, of Birmingham, for certain improvements in gas-burners.

1090. Jean Marie Leonidas Caillaud, of Stratford, Essex, for improvements in removing the fur from the skins of rabbits, and in preparing rabbit, calf, and other skins for tanning.

1091. Gabriel Arthur, of Linares, Spain, for improvements in the manufacture or production of bricks, tiles, and other articles of earthenware.

The above bear date April 17th.

1092. John Smith, of Kidderminster, for improvements in the manufacture of carpets.

1093. Hippolyte Duhamel, of Clichy-la-Garenne, near Paris, for improvements in the fabrication of glass.

1094. Thomas Harris, of Shiffnall, Shropshire, for certain improvements in the mode of constructing and applying horse-shoes.

1095. John Wylie, of Edinburgh, for improvements in piano-fortes.
1096. David Hunter Brandon, of Paris, for improvements in fastenings for shutters, windows, doors, &c.,—being a communication.
1097. George Davies, of Serle-street, for improvements in the method of laying under-ground telegraphic wires,—being a communication.
1098. William Henry Dearing Granville, of Holborn-hill, for improvements in fire-arms, and in the means of loading the same.
1099. Henry Daniel Deane, of Pigott-street, East India-road, Limehouse, for improvements in the floats or paddle-boards of paddle-wheels.
1100. Gustav Jahn, of Bedford-row, for improvements in revolver fire-arms.
1101. Henry Heald, of Sabden, Lancashire, for an improved method of packing pickers employed in looms.
1102. Charles Richard Barnes, of New York, U.S., for improvements in means for hulling and cleaning rice, and other grains having a hull or husk.
1103. Charles Benjamin Normand, of Havre, France, for improvements in generating motive power by the employment of heated air, steam, and gases.

The above bear date April 18th.

1105. Thomas Sanderson, of Edinburgh, for improvements in wheeled carriages.
1106. Richard Ford Sturges, of Birmingham, for a new or improved manufacture of metallic pens.
1107. John Cowdery Martin, of Ferncottage, Putney, for an improvement in the manufacture of paper.
1109. William Thomson, of Dalkeith-gardens, for improvements in stoves or heating apparatus.
1110. Robert Tindall, jun., of Fraserburgh, Aberdeen, N.B., for improvements in harpoon guns and ammunition.
1111. John Stephen Jarvis, of Wood-street, London, for an improvement in the manufacture of stocks or ties for the neck.
1112. John Underwood, of Gloucester-road, Middlesex, for an improved method of printing, and of preparing materials employed therein.
1113. William Clay, of Liverpool, for improvements in the manufacture of iron and steel.
1114. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for certain improvements in meters for measuring the flow of gas, water, or other fluids,—being a communication.
1115. Thomas Wright Gardener Treeby, of Westbourne-terrace Villas, Paddington, for improvements on syphons and parts connected therewith.

The above bear date April 20th.

1116. Henry Wimball, of Aldermaston, Berks, for improvements in pug mills.
1117. Benoit Amédée Fournier, of High Holborn, for preventing on railways those accidents that occur through one locomotive running into another.
1118. William Crighton, of Manchester, and Peter Foxcroft, of Pendleton, Lancashire, for improvements in machinery or apparatus for preparing cotton, wool, or other fibrous substances to be spun.
1119. Amory Fairbanks Sherman, of Roxbury, Massachusetts, U.S., for improvements in machinery for the manufacture of ropes, strands for ropes, and for other purposes.
1120. William Gossage, of Widnes, Lancashire, for improvements in the manufacture of certain kinds of soap.
1121. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in rules and other measuring instruments,—being a communication.
1122. Edwin Marten, of Mitcham, Surrey, for improvements in apparatus for regulating the pressure and supply of gas.
1123. John Chanter, and David Annan, of Bow, for improvements in furnaces when moveable fire-bars are used.
1124. Henry Smart, of Queen's-terrace, Bayswater, for improvements in organs.
1125. Daniel Colladon, of Paris, for improvements in means and machinery for boring and cutting stone, earth, and other like substances, and for ventilating the places where such machinery is employed.

The above bear date April 21st.

1127. William Steel, of Glasgow, for improvements in discharging ashes from steam-boats.

1128. Thomas Burton, of Padiham, Lancashire, and Simeon Lord, of Burnley, in the said county, for an improved self-acting steam-pipe regulator, which is also applicable to drying cylinders, and other similar purposes.

1129. James Higgin, and John Lightfoot, of Manchester, for an improved compound and improvements in the method of applying the same for the purpose of stiffening fibrous or textile materials; the same being applicable to the fixing of coloring matters or pigments.

1130. William Williams, of Liverpool, for an improved propeller for propelling ships, boats, and other vessels.

1131. William Ogden, and Henry Firth, both of Bacup, Lancashire, for improvements in fans or blowing apparatus.

1132. William Kendall, of Blawith, Ulverstone, for improvements in the manufacture of boxes and similar articles, and in the machinery or apparatus to be employed therein.

1133. John Henry Johnson, of Lincoln's-inn-fields, for improvements in sewing-machines,—being a communication.

1134. Robert Taylor, Richard Worswick, and John Lovatt, all of Ipswich, for improvements in railway chairs, and in the mode of securing the ends of rails therein.

1135. Gerolamo Cavanna, of Genoa, for improvements in obtaining motive power.

1136. Richard Boxall Grantham, of Great Scotland-yard, London, and John Grantham, and Henry Sharp, of Liverpool, for improvements in graving docks.

1137. Charles Etienne Osmont, of Rue Neuve Coquenard, Paris, for improvements in pen-holders.

1138. William Robertson, of Manchester, for certain improvements in machines for preparing to be spun, cotton and other fibrous materials.

1139. William Rutt, of Homerton, for improvements in microscopes.

The above bear date April 22nd.

1141. George Welch, of Birmingham, for improvements in metallic pens and pen-holders.

1142. Solomon Philipp Hecht, of Gresham-street, London, for improvements in the manufacture of moulds for making fancy tobacco pipes and other ornamental articles from plastic materials,—being a communication.

1143. Matthew Dunnett, of Glasgow, for improvements in embroidering or sewing, and in machinery or apparatus connected therewith.

1144. James Morison, of Paisley, for improvements in portable shower and sponge baths.

1145. David Milnes, of Bradford, Yorkshire, for an improved manufacture of woven goods or fabrics.

1146. George Scarr, and James Pollard, both of Burnley, Lancashire, for certain improvements in power looms for weaving.

1147. James Taylor, of Cullen, Banffshire, N.B., for improvements in apparatus for producing fire and light.

1148. John Garnett, of Wells-street, Oxford-street, for improvements in the construction of corsets.

1149. Jaques Richard, near Melun, France, for an improved agricultural machine for cleaning grains.

1150. Rudolph Bodmer, of Thavies-inn, Holborn, for improvements in safety valves for steam-boilers,—being a communication.

1151. George Wright, of Sheffield, for improved apparatus for heating.

1152. Albert Demerit Bishop, of Woolwich, for an improvement in the construction of windlasses.

1153. William Colborne Cambridge, of Bristol, for improvements in chain harrows.

1154. Alexander la Paraz, of Gloucester-place, Portman-square, and Josephine Mazel, of King-street, Portman-square, for improvements in preparing paints and varnishes,—being a communication.

1155. André Prosper Rochette, of Brighouse, Yorkshire, for an improvement in currying leather.

1156. John Thomas Way, of Welbeck-street, for an improvement in the manufacture of soap.

1157. André Prosper Rochette, of

Brighouse, Yorkshire, for improvements in currying leather.

The above bear date April 23rd.

1158. Robert Fowler Swift, and Richard Swift, of No. 7 Wharf, Wenlock-road, City-road, and John Cornes, of Balmes-road, Hackney, for improved machinery for washing, wringing, and mangling clothes or fabrics.

1159. Edward Manico, of Bucklersbury, for improvements in obtaining foundations for marine or other structures.

1160. William Clark, of Chancery-lane, for improvements in machinery or apparatus for embroidering,—being a communication.

1161. Jean Baptiste Bellon, of Moorgate-street Chambers, London, for improvements in mordants for use in dyeing processes.

1162. Thomas Craddock, of Tachbrook-street, Pimlico, for certain improvements in the steam-engine and the steam-boiler.

1163. James Caddick, and Thomas Hemmings, of the Garndyn's Iron Works, and David Caddick, of the Ebbw Vale Iron Works, near Newport, Monmouth, for improvements in puddling and balling furnaces for heating and melting iron or steel.

The above bear date April 24th.

1164. Matthew Smith, of Heywood, Lancashire, for certain improvements in looms for weaving.

1165. Samuel Walmsley, of Stockport, for certain improvements in machinery for preparing and spinning cotton and other fibrous materials.

1166. Stephen Tonks, Joseph Breeden, and William Breeden, all of Birmingham, for a new or improved gas-burner,—being a communication.

1167. Samuel Sunderland, and Richard Dean, of Burnley, Lancashire, for improvements in looms.

1168. Edmund Winder Otway, of West Bromwich, for improved apparatus employed in descending and ascending pits or shafts, and raising minerals and other bodies therefrom.

1169. William White, of South Shields, for improvements in making moulds or matrices employed in casting metals.

1170. Thomas Mann, of Aldbrough, near Boroughbridge, Yorkshire, for improvements in horse-powers.

1171. James Simpson, and Edwin Rimmer, both of Manchester, for a certain improvement in Venetian blinds.

1172. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for the application of certain substances not hitherto used for food, as a source of nutrition and support to the respiratory organs of animals,—being a communication.

1173. Charles Thomas Robert Prynn, of Newton Abbot, Devonshire, for an improved apparatus to be used for totally or partially benumbing any part of the human frame previous to a surgical operation, for the purpose of performing the said operations without pain.

1174. William Cory, jun., of Gordon-place, Gordon-square, for an improvement in the manufacture of coke.

1175. The Rev. James Burrow, of Ashford Parsonage, Bakewell, for improvements in coating wrought-iron.

1176. William Pickstone, of Radcliffe Bridge, near Manchester, for an improvement in preparing or manufacturing dyeing matter,—peculiarly applicable to cotton and other vegetable fibres, and useful when dyeing and printing other fibres and fabrics,—being a communication.

1177. Joseph Belshaw, of Nottingham, for improvements in manufacturing knit fabrics.

1178. Augustus Piggott Oldershaw, of Doctors' Commons, for an improvement in apparatus for skidding the wheels of carriages.

The above bear date April 25th.

1179. Amable Victor Felix Larchier, of Paris, for improvements in the manufacture of gas,—being a communication.

1180. Charles Cowper, of Southampton-buildings, for improvements in electro-plating and depositing metals,—being a communication.

1181. Polydore de Keyser, of Cannon-street West, for an apparatus for preventing horses slipping,—being a communication.

1182. William Thompson, and Hamil-

ton Woods, both of Newcastle-upon-Tyne, for improvements in lowering weights by means of cranes, winches, or similar apparatus.

1183. Edmund F. Barnes, of New York, for improvements in telegraphic instruments, and called an "embossing telegraph."

1184. Peter Armand Le Comte de Fontainemoreau, of South-street, for improvements in obtaining motive power,—being a communication.

1185. John Macintosh, of Euston-place, Euston-square, for an improvement in the manufacture of air-beds, cushions, and other like inflated and fluid-tight apparatus or bags.

1186. Alfred Eddington, of Springfield, near Chelmsford, for improvements in machinery for ploughing, tilling, and draining land.

1187. Thomas Dickason Rotch, of Surbiton, for certain new and useful improvements in gas generators,—being a communication.

1188. William Levesley, of Sheffield, for improvements in manufacturing the blanks of forks, scissors, cutlery, chisels, and other tools; which improvements are applicable to the manufacture of springs for pocket knives and other like articles, now prepared by the forging process.

1189. Julien Billiard, of Red-lion-square, for improvements in the arrangements and construction of furnaces and other fire-places,—being a communication.

The above bear date April 27th.

1190. Heinrich Hochstaetter, of Darmstadt, for improvements in the manufacture of matches.

1191. James Withnall, of Manchester, for certain improvements in the manufacture of rollers or cylinders to be employed for printing calico and other surfaces.

1192. Wilson Ager, of Rohrsburg, Pennsylvania, U.S.A., for an improved mode of hulling and cleaning rice.

1193. James Barker, of Blackfriars-road, for an improved propeller for ships and vessels.

1194. Kenneth Leith Sutherland, of the Junior United Service Club, for an improved safety candle lantern.

1195. William Armand Gilbee, of South-street, for an improved mode of reefing and reducing top-sails,—being a communication.

1196. Dennis Grundy, of Tyldesley, Lancashire, for improvements in the manufacture of boots, shoes, and clogs.

1197. Wright Jones, of Pendleton, and Thomas Edwards, of Eccles, both in Lancashire, for an improved lubricator.

1198. John Ramsbottom, of Accrington, Lancashire, and John Bailey, of Salford, for improvements in regulating the flow and pressure of liquids and fluids.

1199. George Newton, of Upper Thames street, for improvements in copying and other presses.

The above bear date April 28th.

1201. Joseph Haythorne Reed, of Charles-street, Berkeley-square, for improvements in propelling ships or vessels.

1202. Charles Pascall, of Norwood, for improvements in tile-making machinery.

1203. John Aitken, of Essex-street, Islington, for an improvement in furnaces for melting the materials of glass, iron, and other metals; and for boiling water and other substances.

1204. Andrew Peddie How, of Mark-lane, for an improved cork-holder for bottles and other vessels.

1205. William Joseph Curtis, of Crown-court, Old Broad-street, for improvements in apparatus to facilitate passengers ascending to and descending from the roofs of omnibuses.

1206. Aimable Antoinette Revel-Busquet, of Paris, for certain improvements in artificial flowers.

1207. François Menusier, of Paris, for an improved bee-hive.

1208. Joseph Bottomley, Christopher Hodson, and William Fielden, all of Rochdale, for improvements in mules for spinning.

1209. George Bartholomew, of Linlithgow, N.B., for improvements in tanners' and curriers' knives.

1210. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for distilling; applicable also to the extraction of oils, coloring matters, and essences, and to

the purification of gums,—being a communication.

The above bear date April 29th.

1211. Frederic Walton, of Haughton Dale Mills, near Manchester, for certain improvements in the manufacture of plastic compositions.

1212. Frederick Walton, of Haughton Dale Mills, near Manchester, for improvements in the manufacture of wire cards for metallic brushes, and for carding fibrous substances, and in the machinery employed therein.

1213. Henry Ball, of Great Russell-street, Birmingham, for improvements in repeating and other fire-arms.

1214. Lucius Henry Spooner, of Munlochy, Rosshire, N.B., for a new or improved manufacture of paper and paper pulp.

1215. Barnard Barcroft, of Radcliffe Hall, near Manchester, for improvements in dyeing and printing.

1216. Thomas Baldwin, of Bury, Lancashire, for improvements in indicators for registering pressure.

1217. John Mc Dowall, of Walkinshaw Foundry, Johnstone, Renfrew, N.B., for improvements in steam hammers.

1218. Samuel Mortimer, of Halifax, for improvements in "screw-gill boxes," used in the preparation of wool and other fibrous substances.

1219. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for moulding and pressing bricks,—being a communication.

1220. Charles Cammel, of Sheffield, for improvements in the manufacture of axles or axle-trees for railway carriages and shafts for various purposes.

1221. George Powers, of Wellclose-square, for an improved scuttle for ships.

1222. Thomas Frederick Hale, of Bristol, for an improved tap or cock.

1223. Samuel Robert Lewis, of Catherine-street, for improvements in trousers.

1225. John Collins, of Birmingham, for improvements in furnaces and flues, and in kilns and drying chambers.

1226. James Anderson, of Glasgow, for improvements in the treatment, application, and use of maize or Indian corn.

The above bear date April 30th.

1227. John Avery, of Essex-street, for an improved washing or fulling machine,—being a communication.

1228. Pierre Alexandre Barteau, Gabriel Guy, and Charles Corroy, all of Paris, for improvements in the production of artificial stone.

1229. Edward Hawkes, of Birmingham, for new or improved machinery for the manufacture of pipes for smoking.

1230. John Ratcliffe, of Blackburn, for improvements in preparing, or in machinery for preparing, yarns or threads for weaving.

1231. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for preventing collisions at sea,—being a communication.

1232. Alfred A. Blandy, of Baltimore, U.S.A. for an improved mode of moulding and casting the plates or bases of artificial teeth.

1233. Richard Leake, and Matthew Sykes, both of Barnsley, Yorkshire, for improvements in consuming smoke and generating heat in furnaces of steam-engine or other boilers, also heating the feed-water of the said boilers, therefore economizing fuel to a great extent.

The above bear date May 1st.

1234. Samuel Hilton, of Albion-street, Bethnal Green, for certain improvements in furnaces.

1235. Edward Tucker, of Belfast, for improvements in the manufacture of starch.

1236. Alfred Augustus De Reginald Hely, of Oxford-street, for certain improvements applicable in the burning of gas.

1237. Prime Raban Jones, of Clapham-rise, for an improved composition for the purpose of curing or preventing the scab in sheep and lambs; which will also greatly promote the growth of the wool, and destroy ticks, lice, and other vermin or impurities; keep the skin clean and healthy, and cure the mange in horses, dogs, and other animals.

1238. Henry Levy, of High-street, Sheffield, for improvements in mole-

skins, velveteens, cords, and such like materials.

1239. Charles Châlet, of Paris, for im-improvements in the manufacture of blinds, screens, reflectors, and other articles of a similar nature.

1240. Alexander John Paterson, of Edinburgh, for an improved method of constructing and propelling vessels.

1241. Joseph Davy, and William Bentley, both of Bradford, Yorkshire, for certain improvements in looms for weaving fibrous substances.

1242. Joseph Seelie Greenhow, of Chelmsford, for an improvement in alarum apparatus when using electric currents.

1243. Adolphe Louis Cauville, of Paris, for improvements in the manufacture of shoes and boots.

1244. Benjamin Chew Tilghman, of Philadelphia, for improvements in treating fatty and oily substances.

1245. John Marland, of Lawrence, Massachusetts, U.S.A., for improvements in cop tubes used in spinning.

1246. William Edward Wiley, of Great Hampton-street, Birmingham, for improvements in boxes or cases for containing needles, leads for pencils, pens, and other articles.

1247. John Peter Booth, of Cork, for an improved manufacture of stuffing for beds, couches, cushions, and other seats.

1248. Peter Fairbairn, of Leeds, and Thomas Marsden, of Broughton, near Manchester, for improvements in machinery for heckling flax, hemp, tow, and other fibrous materials.

1249. Tertius John Cooke, of Wolverhampton, for improvements in the manufacture of knobs, roses, and escutcheons used for doors, drawers, shutters, and other similar purposes.

The above bear date May 2nd.

1250. John Fox, of Preston, Lancashire, for improvements in the music scale, and musical instruments.

1251. Agostino Gatti, of Coppice-row, Clerkenwell, for improvements in the making of all kinds of seeds, buds, and fruits, for artificial flowers and fruits.

1252. John Stanley, of Whitechapel-road, for improvements in the construction and mode of applying cranes and other hoisting machines, to hoisting, suspending, lowering, and weighing purposes,—also in generating, transmitting, and applying motive power for the same.

1253. Thomas Beeby Moseley, of Upper Charlotte-street, Fitzroy-square, for an improved pneumatic holder adapted for photographic and other purposes.

1254. Joseph Howard the younger, and William Howard, both of Leek, Staffordshire, for improved apparatus for the manufacture of cheese.

1255. William Edward Wiley, of Birmingham, for improvements in ever-pointed pencils.

1256. John Leslie, of Conduit-street, Hanover-square, for improvements in apparatus for ventilating buildings.

1257. Spendlove Desborough, of Noble-street, for an improvement in the manufacture of the seal flaps of envelopes and letter paper.

1258. John Thomas Way, of Welbeck-street, Middlesex, for improvements in obtaining light by electricity, and in employing light, so obtained, for light-houses, and for giving signals.

1259. George Travis, of Mercaston, Derbyshire, for improvements in apparatus used in the manufacture of cheese.

1260. Jules Alexandre Petiet, of Rue Lafayette, Paris, for improvements in actuating railway breaks.

1261. Archibald Turner, of Leicester, for improvements in the manufacture of elastic fabrics, and for the application of such fabrics to the manufacture of boots and shoes.

1262. Edward Davis, of Leeds, for an improved construction of pressure gauge.

1263. Bennett Johns Heywood, of Leicester-square, for an improved construction of self-closing valve, and means for rendering the same applicable for supplying or discharging air, water, and other fluids.

The above bear date May 4th.

1264. Juste Herrero, of Rue Vivienne, Paris, for an improved inking and stamping machine.

1265. John Talbot Pitman, of Gracechurch-street, for an improvement in the construction of curry-combs,—being a communication.

1267. Thomas Keddy, of Birmingham, for new or improved machinery for cutting sugar and other substances.

1268. Louis Le Chevalier Cottam, of Winsley-street, Oxford-street, for improvements in stable fittings.

1269. William Bond Paul, of Langport, Somersetshire, for improvements in signalling upon railways.

1270. William Wilkins, of Wapping, for an improved method of laying submarine telegraph cables.

1271. John Easterbrook, and Robert Francis Drury, both of Sheffield, for improvements in machinery or tools for drilling and boring.

1272. Henry Elliott Hoole, of the Green-lane Works, Sheffield, for improvements in stove grates.

1273. Levi Bissell, of New York, for improvements in trucks for locomotive engines.

The above bear date May 5th.

1275. George Kennedy Geyelin, of Lothbury, for making oscillating spring laths for beds, couches, and other purposes.

1276. Benjamin Hingley, of Cradley, Worcestershire, and Samuel Hingley, of Cradley, aforesaid, for improvements in anchors.

1277. William Hood, of Edgbaston, for an improved charcoal filter for rectifying and cleansing spirits, and which is also applicable for filtering water and other fluids.

1278. Henry Tibbetts Ropes, of Liverpool, for improvements in refrigerators or portable ice-houses,—being a communication.

1279. Arthur Kinder, of Worcester, for improvements in cutting irregular forms, and in the machinery or apparatus employed therein or connected therewith.

1280. Henry Hogarth, of Adelphi-terrace, Strand, for an improved apparatus for raising and floating vessels or other heavy bodies.

1281. Matthew Semple, of Stonehouse, Plymouth, for an improved pipe tube or stem.

1282. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in machinery for pulverizing clay and other substances,—being a communication.

1283. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for manufacturing paper; part of which is applicable to other purposes,—being a communication.

1284. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in locks for doors, safes, and other purposes,—being a communication.

1285. Frederick Martin Schwab, of Carlisle-street, Middlesex, for improvements in breech-loading firearms.

The above bear date May 6th.

1287. Ernst Ziegler, of Heilbronn, Wurtemberg, for a substitute for animal charcoal, applicable also as a coloring matter.

1288. Herbert Mackworth, of Clifton, Gloucestershire, for improvements in the classification, preparation, and treatment of mineral substances, coke, and furnace cinders, and in removing and depositing such substances, and in machinery and apparatus for such purposes.

1289. Charles William Ramié, of Camberwell, for improvements in the mode of attaching knobs to spindles.

1290. Richard Bennett, of Redditch, Worcestershire, for a new or improved method of papering needles, or making up needles for sale.

1291. Duncan Morrison, of Bordesley Works, Birmingham, for a new or improved manufacture of rollers or cylinders for printing fabrics.

1292. William Charles Aberdein, of Shepperton Cottages, New North-road, Islington, for the tubular elastic fastener and stud for gentlemen's shirt collars and wristbands, and other garments.

1294. Charles Tilston Bright, of Harrow, and Charles De Bergue, of Dowgate-hill, London, for improvements in apparatus to be employed in the laying or sinking of submarine telegraph cables.

1295. John Stenhouse, of Upper Barnsbury-street, Islington, for improvements in the manufacture of various kinds of glue or gelatine.

1296. Louis Charles Dolléans, of Paris, for improvements in ornamenting porcelain, china, opal-glass, and similar products, by lithographic,

chromo-lithographic printing and gilding.

1297. George Brook Price, of Bedford, for improvements in apparatus for affixing stamps and labels to letters and documents.

1298. John Crawford, of Glasgow, for improvements in heating and cooking apparatus.

1299. James Hedgely, of Westbourne-street, Eaton-square, for improvements in lamps for railway carriages.

1300. William Colborne Cambridge, of Bristol, for improved machinery for winnowing corn and separating seeds.

The above bear date May 7th.

1301. Frederick Grindlay Howard Woodward, of Horatio-terrace, Trafalgar-road, Old Kent-road, for medicine for the cure of dropsy.

1302. Caleb Tayler, of Deptford, for improvements in the manufacture of sheets of material suitable for covering floors, and for other useful purposes.

1303. Charles Edward Darby, of Brymbo Iron Works, near Wrexham, for improvements in collecting the inflammable gases generated in blast furnaces.

1304. Theodore Lipkan, of Paris, for an improved antisyphilitic compound.

1305. Joseph William Schlesinger, of the Grove, South Lambeth, for improvements in the backs and covers of account books and other books,—being a communication.

1306. Louis Heinemann, and Arnold Heinemann, of Manchester, for improvements in waterproofing woven fabrics and fibrous materials.

The above bear date May 8th.

1307. William Glover, of Manchester, for improvements in machinery for weaving.

1308. George Heppell, of Uttoxeter, for improvements in ventilating mines and such like places.

1309. William Hebdon, of Weedon, for testing the strength of woollen cloth, linen, and all other woven fabrics; also of every description of material upon which a strain can be exerted.

1310. John Henry Francis, of Ossulston-street, Saint Pancras, and Robert Ord, of Morpeth Cottage, East-street, Islington, for improvements in the means and apparatus employed for cleaning casks.

1311. William Player Miles, of Dartmouth-villas, Perry Vale, Sydenham, for an improved gauge cutting machine.

1312. John Saxon Maccarthy, of Newman-street, Oxford-street, for improvements in driving or ramming paving-blocks and other surfaces.

1313. Francis Watkins, of the Victoria Works, Smethwick, for improvements in machinery for making rivets, bolts, and spikes,—being a communication.

1314. Andrew Peddie How, of Mark-lane, for improvements in circular brushes for sweeping boiler and other tubes.

1315. John Pym, of Pimlico, for improvements in machinery to be employed on the water for raising and lowering weights.

1316. Henry Hobbs, of Cambridge-street, Saint Pancras, and Edward Easton, of the Grove, Southwark, for an improved mode of preventing the incrustation of steam-boilers.

The above bear date May 9th.

1317. Robert Wilson, of Patricroft, near Manchester, for improvements in machinery or apparatus for raising or forcing fluids.

1318. James John Myers, of Bugle-street, Southampton, for a new method of regulating paper laid on to be printed on one or both sides, at and by cylinder printing-machines, by means of guides, whereby the present waste of paper in progress of printing is avoided.

1319. Alfred Dawson, of Barnes-place, Mile-end-road, for an improved wrought-iron cock, suitable for water, steam, or gas.

1320. Charles William Siemens, of John-street, Adelphi, for improvements in furnaces, and in the application of heated currents.

1321. John Miller, of New Lanark, N.B., for improvements in oil-cans or apparatus for lubricating machinery.

1322. John Miller, of New Lanark, N.B., for improvements in water-meters.

1323. William Geddes Borron, of Glasgow, for improvements in closing

or stoppering bottles, jars, and other receptacles.

1324. John Davies Mucklow, of Blackford Bridge, for certain improvements in the manufacture of rollers or cylinders to be employed for printing calico and other surfaces.

1325. Richard Fitton, of Oldham, and Samuel Hall, of the same place, for certain improvements in machinery or apparatus for spinning cotton and other fibrous substances.

1326. Samuel Hallett, of Clarges-street, Piccadilly, for improvements in piano-fortes,—being a communication.

1327. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for cutting veneers,—being a communication.

1329. Richard Archibald Brooman, of Fleet-street, for an improved locomotive apparatus for rail and ordinary roads,—being a communication.

The above bear date May 11th.

1331. Edwin Cotterill, of Birmingham, for a new or improved method of preventing the picking of ordinary locks and other fastenings.

1332. Claude Antoine Busson, of Paris, for improvements in rotary engines.

1333. Rose Celestine Carbonino (Widow de Favre), of Paris, for improvements in nose-bags.

1334. John Westlake, of Helston, Cornwall, for improvements in cleaning, separating, and dressing ores of pulverized tin, copper, lead, silver, and other minerals, ores, and substances.

1335. James Drysdale Malcolm, of Leicester-square, for improvements in the construction of buffing apparatus for railway engines and carriages.

1336. William Henry Barlow, of Derby, and William Hemingway Mills, of Great George-street, Westminster, for improvements in the permanent ways of railways.

1337. Thomas Lambert, of Short-street, New Cut, and Obed Wakefield, of Lambeth-terrace, for improvements in apparatus for drawing off water and other fluids.

1338. Julian Charles Dubois, of Rue de Cherche Midi, Paris, for improvements in castors.

1339. Richard Archibald Brooman, of Fleet-street, for improvements in the preparation of steel, and in the steeling or manufacture of tyres, shafts, axles, and other forgings,—being a communication.

1340. John Richard Cochrane, of Glasgow, for improvements in the treatment or manufacture of ornamental fabrics.

1341. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in furnaces specially adapted to the generation of steam for motive power, but applicable to furnaces for other purposes,—being a communication.

1343. William Massey, of Newport, Salop, for improvements in engines for the cultivation of land by steam-power.

The above bear date May 12th.

1344. Thomas Briggs, of Woodhouse-lane, Leeds, and John Starkey, of Parker-street, Liverpool, for improvements in machines for washing, wringing, and mangling.

1345. Stephen Yeldham, of Stamford-street, London, for the better application and arrangement of indices to books of all kinds.

1346. William Wolfe Bonney, of Fulham, for a chemical composition or agent to be employed in lieu of, or to be substituted for, argol, tartar, and tartaric acid,—being a communication.

1347. Edward Eley, of Union-place, City-road, for improvements in the manufacture and application of pipes for heating purposes.

1348. Henry Tolkien, of London, and Joseph Middleton, of Finsbury, for improvements in piano-fortes.

1349. Abraham FitzGibbon, of Canada, for improvements in the form of rails for use in railways and tramways.

1350. Robert Stirling Newall, of Gateshead, for improvements in the manufacture of wire strands for electrical purposes.

1351. Richard Dugdale Kay, of Accrington, Lancashire, for improvements in machinery or apparatus for printing woven or felted fabrics,—being a communication.

1352. Nathan Ager, of Upper Ebury-street, Pimlico, for improvements in connecting spindles of locks and latches with their knobs and handles.

1353. John Peak, of Wigan, Lancashire, for improvements in the manufacture of gas.

1354. Michael Henry, of Fleet-street, for improvements in winding weft, and in the machinery employed therein,—part of which is applicable to spinning machinery,—being a communication.

1355. Joseph Fielding, of Ashton-under-Lyne, for an improvement in apparatus applicable to steam-pipes or cylinders used for heating and drying, which said apparatus may be similarly employed wherever steam is used for such purposes.

1356. William Adams Alderton, of Brighton, for improvements in spindles for door-locks, latches, and other similar purposes.

The above bear date May 13*th.*

1358. Valentin Sauerbrey, of Basle, (Switzerland), for improvements in the manufacture of fire-arms.

1359. William Sissons, and Peter White, both of Kingston-upon-Hull, for improvements in steam pile-driving machinery.

1360. William Ashby, of Croydon, for improvements in water wheels.

1361. William Hyde, and Joshua Hyde, of Dudley, for improvements in the construction of vices.

1362. David Hesse, and Max Hesse, both of Manchester, for certain improvements in the mauufacture of shirts, shirt fronts, and other articles of wearing apparel.

1363. George Crawford, of Edinburgh, N.B., for improvements in piano-fortes.

1364. James Stevenson, jun., of Glasgow, for improvements in lighting apartments and passages.

1365. Edmund Hollingworth, of Weston Underwood, Derbyshire, for improved machinery or apparatus for washing linen and other articles.

1366. James Sharrocks, of Lower Healey, near Rochdale, for improvements in machinery or apparatus for pressing bricks, tiles, and other plastic substances.

1367. Daniel Reading, of Claverdon, Warwickshire, for a new or improved spring for carriages or other vehicles.

1368. John Carr, of Killyleagh, County Down, Ireland, for improvements in machinery for hackling flax, hemp, and other fibrous substances.

1369. Charles Bartholomew, of Rotherham, and John Heptinstall, of Masbro', Yorkshire, for improvements in machinery for rolling tyres and hoops for railway and other wheels, and also other articles made of iron and steel.

The above bear date May 14*th.*

1370. Joseph Aizlewood, of Baths Foundry, Rotherham, for improvements in hat and umbrella stands.

1371. Michael Joseph Vanderborght, of Brussels, for a new system of machinery producing simultaneously the three-fold effect of casting, breaking-off, and rubbing (smoothing) of printing characters.

1372. William Hartley King, of Netherend, near Stourbridge, for improvements in kilns and stoves.

1373. Frederic Whitaker, of Islington, for improvements in the construction of machinery for sewing and embroidering.

1374. Robert Porter Walker, of New York, for improvements in machinery for hulling and scouring coffee and similar substances.

1375. Isaac Whitesmith, of Glasgow, and William Whitesmith, of the same place, for improvements in weaving.

1377. David Carter, of Honley, near Huddersfield, for improvements in machinery or apparatus for cleansing the waste of woollen or other fibrous manufactures, or for recovering the wool or other fibres from such waste substances or materials.

1378. Edward Gripper, of Winchester Wharf, Bankside, for improved machinery or apparatus for washing, drying, and cleansing corn, seed, Egyptian beans, or other pulse.

1379. Sophia Sands, of Nottingham, for improvements in the manufacture of fringes,—being a communication.

1380. William Marriott, and David Sugden, of Huddersfield, for improvements in heating press-plates for pressing woollen, worsted, cotton, silk, or other fabrics, paper, and other articles.

1381. Richard Archibald Brooman, of Fleet-street, for an improvement in

the construction of oil-cans,—being a communication.

1382. Richard Archibald Brooman, of Fleet-street, for improvements in machinery to be employed in the refining of sugar,—being a communication.

1383. Francis Parker, of Elm House, Homerton, for an improved tell-tale for public vehicles.

1384. Henry Brown, of Whitechapel-road, for an improved material resembling ivory.

The above bear date May 15th.

1385. Charles William Ramié, of Camberwell, for a mode of attaching handles to table cutlery.

1387. Henry Trappes, of Manchester, for an improvement in the construction of a sliding drawer, applicable to all steam-engines, either fixed or locomotive, for the distribution of steam, aeriform, or liquids, used either as a motive power or for any industrial or artistic purpose,—being a communication.

1389. Joseph Ellis, of Port Hope, Canada, for improvements in the manufacture of artificial stone.

1391. Nathaniel Ogle, of Jersey, for an improved method of propelling and ventilating ships.

1393. Richard Bradly, and William Craven, both of Wakefield, Yorkshire, for improvements in machinery or apparatus for making bricks and tiles.

The above bear date May 16th.

1395. John Avery, of Essex-street, for improvements in mills for grinding corn and other like substances,—being a communication.

1397. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the manufacture of boots, shoes, and other coverings for the feet,—being a communication.

1399. William Clark, of Chancery-lane, for improvements in the manufacture of silk, and in the machinery used therein,—being a communication.

The above bear date May 18th.

1401. John Carnaby, of Snow-hill, for an improved registering index for gas and other meters.

1403. Charles Reeves, of Birmingham, for new or improved grinding and polishing machinery, to be used in the manufacture of knives, matchets, swords, and other similar articles.

1405. Julius Friedrich Philipp Ludwig Von Sparre, of Eisleben, Prussia, for improvements in separating substances of different specific gravities, and in the machinery and apparatuses employed therein.

1407. William Whitehead, of Huddersfield, for improvements in cards for Jacquard mechanism.

1409. John Watson Burton, and George Pye, both of Ipswich, for an improvement in pressing and crushing flax, hemp, and other fibrous substances.

1411. Louis Cornides, of Trafalgar-square, for improvements in the manufacture of gelatine and glue.

The above bear date May 19th.

1413. John Hardley, of Shide, Isle of Wight, for an improved apparatus for bruising and grinding vegetable substances.

1415. Paul Ingwersen, of New Oxford-street, for a certain remedy to prevent and dissolve the deposits in boilers and steam generators,—being a communication.

1417. Henry Keogh, of Hugh-street, and Ffrench Augustus Keogh, of Inner Temple, for lighting the public gas lamps in the cities and towns of Great Britain and Ireland by electricity, and for turning off and on the gas to same simultaneously.

1421. Elijah Aldis, of Manchester, for improvements in cramps for flooring and other purposes.

1423. James Abbot, the younger, of Bilston, Richard Handley Thomas, of Kidsgrove, John Young, of Bilston, and James Edward Hunt, of Highfields, near Bilston, all in Staffordshire, for improved machinery for blooming iron.

1425. James Honiball Tozer, of Liverpool, for improvements applicable to travelling caps and other coverings for the head.

1427. William Clark, of Chancery-lane, for improvements in the preparation of the coloring matter called murexide,—being a communication.

1429. Edward Curtis Kemp, of Avon-place, Birmingham, for improvements in unions for gas pipes and other pipes or tubes,—being a communication.

The above bear date May 20th.

1431. Peter Armand Le Comte de Fontainemoreau, of London, for certain improvements in the processes for detaching or separating calcareous rocks,—being a communication.

1433. William Blacklidge, jun., of Hoghton, Lancashire, and George Read, of Bolton-le-Moors, for certain improvements in the construction of churns; which said improvements are also applicable to other agitating or stirring apparatus.

1435. William Foster, of Black Dike Mills, Bradford, Yorkshire, for improvements in the making of worsted and woollen yarn.

1437. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved method of sewing or stitching fabrics together,—being a communication.

The above bear date May 21st.

1439. John George Taylor, of Glasgow, for improvements in writing materials.

1441. Christophe Muratori, of Rue Lafitte, Paris, for obtaining a new sort of white by silicate of magnesia and oxide of zinc, or by silicate of magnesia and carbonate of lead,—in the first case a composition of zinc, and in the second a composition of lead.

The above bear date May 22nd.

New Patents.

Sealed under Patent Law Amendment Act, 1853.

1856.

35. Thomas Forsyth.
77. J. H. Johnson.
137. G. T. Bousfield.
151. Nicholas Fortune.
291. W. E. Newton.
365. P. M. Parsons.
459. John Goodman.
541. Alexander Parkes.
648. J. Woodley and H. H. Swinford.
771. Samuel Campbell.
789. William Johnson.
883. A. J. Quinche.
929. David Joy.
983. J. F. V. Larnaudès.
991. A. V. Newton.
1059. A. V. Newton.
1061. Henry Willis.
1091. Gabriel Arthur.
2736. G. Watson and C. Satterthwaite.
2739. Samuel Fox.
2741. Samuel Fox.
2757. J. W. Clare.
2762. William Jacobs.
2763. Joseph Barrans.
2765. R. A. Brooman.
2768. Alexander Clark.
2769. W. T. Henley.
2771. A. R. Terry.
2774. Joseph Wheeler.
2775. R. A. Brooman.
2776. J. S. Wright.
2787. Henry Brickley.
2789. John Orr.
2802. F. N. Clerk.
2810. William Woofe.
2812. Henry Hedgely.
2818. J. M. Saunders.
2819. H. T. Sourbuts.
2820. Henry Waller.
2824. C. W. Siemens.
2825. James Dryden.
2832. Richard Harmer.
2836. John Gedge.
2837. John Gedge.
2838. J. C. Haddan.
2839. John Gibson.
2840. G. Collier and John Crossley.
2846. Noel Monnier.
2849. John Longbottom.
2851. R. A. Brooman.
2852. R. A. Brooman.
2853. R. A. Brooman.
2854. L. D. Girard.
2858. Matthew Townsend.
2862. James Mizen.
2865. Emory Rider.
2866. Thomas Crabtree.
2867. A. and W. Bullough.
2868. Henry Genhart.
2869. Julien Denis.
2870. Joseph Deeley.
2871. J. K. Cheetham.
2876. Henry Moore.
2884. J. Apperly and W. Clissold.
2885. R. Davison and J. Crowther.
2892. H. Ogden and H. Hibbert.
2896. Christian Schiele.
2901. S. R. Smith.
2902. John Leslie.
2910. R. F. Miller.
2911. Edward Burwell.

2915. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith.
2918. Anne M. Macé.
2920. Joseph Walton.
2926. W. & S. Storey.
2927. Alexander Macarthur.
2930. John Cornes.
2931. Jacob Green.
2932. Joseph Chatwin.
2936. T. and W. Wheatley.
2940. William Lund.
2944. W. P. Miles.
2945. Charles Humfrey.
2946. Henry King.
2950. J. T. Wright and E. P. Wright.
2952. E. Paton and C. F. Walsh.
2954. Henry Wimball.
2956. J. H. Headley.
2960. George Sherwin.
2963. John Smith.
2965. John Metcalf.
2975. William Austin.
2976. C. F. Vasserot.
2980. F. W. Gerhard.
2985. John Smith.
2988. John Platt.
2990. F. Levick and J. James.
2993. Viscount Carlingford.
2995. F. B. Howell.
3003. John Brown.
3004. François Donny.
3010. J. Penny and J. Booth.
3011. John Murdoch.
3015. Thomas White.
3016. G. A. Harrisson.
3017. Edward Loos.
3018. Thompson Newbury.
3023. W. J. Payne.
3028. T. L. Thurlow.
3034. W. B. Johnson.
3035. William Smith.
3036. Frederick Prince.
3037. J. S. Bailey.
3038. William Spence.
3039. J. R. Dick.
3044. James Lark.
3049. Alfred Heather.
3052. William Macpherson.
3054. William Taylor.
3057. R. A. Brooman.
3062. David Macdonald.
3064. A. J. B. L. de Marcescheau.
3065. William Irlam.
3070. H. H. Goodman.
3075. R. R. Cox.
3078. Thomas Shaw.
3081. William Swain.
3082. George Ritchie.
3084. I. Atkin and M. Miller.
3089. Timothy Alden.
3090. J. J. Speed and J. A. Bailey.
3092. J. L. C. Le François de Grainville.
3093. W. E. Newton.
3097. R. A. Brooman.
3102. William Bray.

1857.

5. E. T. Noualhier and J. B. Prévost.
14. E. V. J. L. Gorges.
30. W. E. Newton.
37. Andrew Brundish.
62. H. C. Hill.
96. R. A. Brooman.
102. G. Eskholme and H. Wilkes.
103. Richard Chrimes.
117. W. E. Newton.
123. Joseph Higham.
127. A. V. Newton.
155. W. H. Mitchel.
163. A. V. Newton.
207. G. Eskholme and H. Wilkes.
208. P. A. Le Comte de Fontainemoreau.
240. G. T. Bousfield.
366. James Murdoch.
379. Julian Bernard.
389. J. F. Watson.
440. John Cruikshank.
532. Aimé Koch.
552. W. E. Newton.
557. M. H. Picciotto.
592. H. W. Tyler.
667. Charles Lungley.
674. George Philcox.
690. J. G. Marshall.
716. J. Shaw and W. Manwaring.
717. W. E. Newton.
736. James Thomson.
746. G. F. Remfry.
758. Thomas Yarrow.
776. T. S. Adshead and A. Holden.
836. John Henderson.
853. George White.
860. George Gilmour.
863. William Ross.
887. S. J. Goode.
888. F. C. Hills.
889. G. Lauder and T. Ireland.
900. John Leslie.
945. R. Birkin, jun., and T. I. Birkin.
959. G. T. Bousfield.
961. Samuel Clarke.
963. A. V. Newton.
968. W. C. Day.
970. Ebenezer Rogers.
1069. F. Richardson and M. Prentice.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S
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NEW SERIES.—No. XXXII.

PERSONAL NARRATIVE OF THE ORIGIN AND PROGRESS OF THE CAOUTCHOUC OR INDIA-RUBBER MANUFACTURE IN ENGLAND.—BY THOMAS HANCOCK.*

THERE is nothing which demonstrates so clearly the wonderful provisions of nature as a comparison of the peculiar characteristics of inorganic and organic substances in common use in the arts, and the laws by which they are governed; but our very familiarity with these facts is, perhaps, the cause why they are relatively so little considered. To revert, for a moment, to one group of substances—the metals (of which perhaps our chemists have yet more to discover before they have exhausted all nature's secrets under this head)—what marvellous evidence of order and harmony in creation is presented in the fact, that all the metals have their different points of fusion and distinct affinities, which permit of their being readily distinguished and separated from each other! Then again, how different naturally must be their molecular arrangement, since some can be rolled out into sheets like dough, or beaten into the finest conceivable tissues—while others, under like circumstances, will only yield to a crushing pressure! The individual characteristics of the various well-known metals, in their pure and compound state, which rendered them each adaptable to special uses, had so long been familiar to the world, and coupled with these were a thousand other facts of the mechanical and chemical properties of other substances, all indicative of the boundless capabilities of nature to provide whatever the needs of humanity might require, that they would seem almost sufficient, long ago, to have led men, by inferential reasoning, to the conclusion that wherever there was an evident break in the round of nature's provisions, in that respect human knowledge was deficient, and there yet remained to be discovered some substance distinct from all that had hitherto been applied to the arts. That there was a visible want, before the introduction of caoutchouc or india-rubber to the civilized world, and one that nature might, by analogy, have been supposed capable of removing, will be apparent, when we remember the close relation between animal and vegetable life, and what organism and functions they possess in common. The anatomist had however studied the action of the muscles in the animal economy, and witnessed their ex-

* Longman & Co., Paternoster Row.

pansive and contractile properties, without, as it would seem, imagining that nature could have re-produced those properties in the vegetable kingdom. He had also noticed, in common with all the world, the expansion and contraction of the skin, but knew of nothing which could artificially imitate that peculiarity. The introduction into Europe of a vegetable product—the juice of a tree—and known to us best under the term of india-rubber (from its being imported first from the West Indies, and employed by artists and others to remove pencil marks by friction), has, however, furnished us with the means of imitating this natural faculty, the application of which to the arts is most important; besides which it affords us protection against the elements. The year in which the knowledge of the existence of india-rubber is said to have reached Europe is 1735; but it was not until a century had nearly expired that we find it employed in the industrial arts.

Mr. Hancock, who has received the title of the Father of the India-rubber Manufacture, in his Personal Narrative of its origin and progress, says,—"the more I thought about it and tested its properties, the more I became surprised, that a substance possessing such peculiar qualities should have remained so long neglected;" he therefore applied himself to the subject, and in his earliest attempt endeavoured to render available its elastic property. In the year 1820, he patented the application of the crude rubber, in strips, "to the wrists of gloves, to waistcoat backs and waistbands, to pockets, to prevent their being picked,—to trousers and gaiter-straps, to braces, to stockings and gaiters, to riding belts, to stays, to boots, shoes, clogs, and pattens, when the object is to put them on and off without lacing or tying,—to the soles of shoes and boots, &c." This was, as we believe, the first beginning of the "rubber manufacture," as it is now termed; but Mr. Hancock did not, in the specification of his patent, develope any new property possessed by the rubber, or indicate any new mode of treating it: his right, however, to the title of Father of the India-rubber Manufacture is due to an important discovery which he made about this time, and kept secret for the long period of twelve years: this is what is now known as the masticating process. By it he was enabled to reduce crude rubber to a plastic state, and form it into sheets or blocks as desired. Whether he was at this period possessed of the knowledge of the solvents of india-rubber is not very clear; but in the specification of his next patent, dated March, 1823, he speaks of the use of the essential oils for dissolving the rubber, and expressly disclaims their use, "the same having been heretofore known and used." In following Mr. Hancock's narrative, we get a very imperfect notion of the progress of the rubber manufacture, for he confines himself to the detailing of his personal experiences, whereas, the art, in its present advanced state, is essentially of American growth, although it may, perhaps, justly be said to have originated here. His

sketch, which is, in the main, a careful, honest, and ungarnished statement, is, however, acceptable, as it shews how far the public are indebted to him, and does not detract from the merits of others. The second patent of Mr. Hancock was for mixing pitch and tar with rubber, to form a composition for covering ships' bottoms; and in the same year (1823), Mr. Macintosh patented his celebrated waterproof cloth, which consisted of india-rubber varnish laid between two thicknesses of woven fabric. The naphtha used as the solvent by Macintosh, imparted a most disagreeable odour to the waterproof goods, and for a long time presented an insurmountable bar to their general adoption. Nevertheless, of the two evils, the odour, or the want of protection against the weather, the travelling public chose the former, and thus was introduced a most important branch of manufacture. The fabric was found not only to be impervious to water, but also, practically, impervious to air; and therefore susceptible of conversion into life preservers, air cushions, boats, and other floating bodies. The similarity of their pursuits seems to have brought these early pioneers together in 1825, when Hancock, by his means of dissolving the rubber, mitigated, in some degree, the disagreeable smell of the goods. In the following year he undertook to manufacture the Macintosh fabric for the supply of tailors and others, who were to convert it into waterproof garments. With the desire, perhaps, of leaving the trade undisturbed, he purposely avoided, at the outset, the making up of garments, and gave the purchasers of the fabric such instructions as would (if followed) have enabled them to make them tolerably waterproof. These knights of the thimble, however, utterly regardless of advice, so pierced and pricked the fabric with needles and pins, that it became porous at all the seams, and at many parts of the surface, and for the purpose of resisting water, it was utterly useless. In order, therefore, to save the credit of the manufacture, the goods were manufactured solely by the patentee and his licensees; and thus, from time to time, improvements, suggested by experience and continued experiments, were introduced, until the manufacture attained to its present excellence. Many difficulties had, however, first to be encountered and overcome, but more of this hereafter.

In the year 1824, Mr. Hancock received from Central America a considerable quantity of rubber in the pure liquid state, as drawn from the trees. It came over in stoppered vessels. The liquid he describes as "of the consistence of thick cream, and of exactly the same color. * * When the moisture was evaporated from it by exposure to the atmosphere, the residue was pure rubber of the finest quality; but it had lost more than one half of its weight." This material, he conceived, might be employed with advantage in saturating felt, carded cotton, and hair, and so producing an artificial leather; but subsequent attempts to obtain the liquid rubber having failed, from its liability to

change during transport, owing to access of air thereto, he abandoned the proposed manufacture. To continue the thread of his narrative, Mr. Hancock seems to have contented himself, until the year 1840, in following rather than directing the demands of the public for the pure rubber and the waterproof fabric, in their various obvious applications; the chief development during that period having been in the cutting of strands or fine threads of rubber and introducing them into braided or woven fabrics. The credit of this idea, which superseded his plan of employing rubber springs, as patented by him in 1820, he gives to a German. On this subject, he says, "I have understood that a German, whose name I am not acquainted with, conceived the idea of introducing a thread of rubber into a woven web or fabric, so as to form a warp, and by keeping it confined in an extended state during the operation of weaving, and then releasing it, the fabric would be gathered up and elasticated." This was an important improvement, which became extensively adopted (particularly in the hosiery and glove trade) as soon as machinery could be brought to bear to cut the thread. The earliest in the field, and those who most distinguished themselves in the production of elastic braid, bands, and cords, were Mr. Robert Sievier, Mr Joshua Procter Westhead, and Mr. Christopher Nickels; the latter of whom had been associated with Mr. Hancock in establishing a rubber manufactory in Paris in the summer of 1828, and continued for some years to conduct the new business. In 1837, the manufacture of the waterproof cloth was somewhat modified, the rubber being reduced to a doughy state by mastication, instead of a varnish, and then rolled into sheets and moistened with a solvent. While in this plastic state it was spread upon the cloth to be coated, and the coated cloth was made to pass over a flat iron chamber, heated by steam, by which means the small quantity of solvent contained in the rubber was evaporated. This is the process in use at the present day. But our successful manufacturer was not without his reverses. In the year 1834, his London factory was destroyed by fire; and again, in 1838, the fire-proof building of Messrs. Macintosh & Co., at Manchester, was entirely destroyed, the heavy machinery breaking through the arched floors and killing some of their workmen below. He had also, after the manufacture was well established, at times produced large quantities of defective goods, without being able to detect the cause. On one occasion, when the defective pieces happened to be worsted goods, he was fortunate enough to discover that the decomposition of the rubber had been caused by the greasy matter retained in the cloth after the scouring process, which had been imperfectly performed by the manufacturers; and he was thus enabled to shift the loss, amounting to £900, on to their shoulders.

We now approach the time when that great discovery was made which completely revolutionized the rubber manufacture, and rendered

that material applicable to a thousand unforseen uses. A common complaint against the Macintosh garments was, that, besides the offensive odour which they emitted, while under the process of seasoning by use, they had the disadvantage of requiring to be thawed in cold weather at a fire, before being worn, as their normal condition was as "stiff as a deal board." This action of cold, by which the rubber was for the time robbed of its elastic quality, and the opposite effect of heat which destroyed its tenacity, and permanently injured the fabric, greatly limited the applications of india-rubber; it was therefore a matter of considerable moment to render it permanently elastic, or not susceptible of change under varying temperatures. The discovery was eventually made and patented in the years 1843-4, but the claim to the invention long remained a matter of dispute, and afforded profitable occupation to the legal profession. It is, perhaps, owing to this dispute that the personal narrative under review was prepared for the press. Mr. Hancock's explanation of the circumstances surrounding this great discovery, is straightforward, and we are compelled to admit that he makes out a good case in substantiation of his legal claim to the invention. With respect to his early connection with what is now known as the "vulcanizing process," that is, the intimate admixture of rubber and sulphur, and the submitting of the compound to a degree of heat which renders it permanently elastic, Mr. Hancock says, that his attention was first called, in the year 1840, to two specimens of rubber cloth of a dingy yellow color. These were the only rubber articles he had yet seen that were not of either English or French manufacture. The yellow tinge was produced by sulphur, and the appearance of the article was by no means good. About this time he became associated with Mr. Brockedon, the inventor of the elastic stoppers for bottles, and was engaged in perfecting those articles and fitting them for general use. This gentleman, being known to be interested in the rubber manufacture, was presented, "by a person from America, who represented himself as the agent of the inventor," with some bits of rubber which would not stiffen by cold, and were not much affected by solvents, heat, or oils. Portions of these Mr. Brockedon presented to Mr. Hancock, informing him at the same time that the mode of manufacturing the rubber was a secret. The agent, we are told, was recommended to Messrs. Macintosh & Co., and they being in the dark as to the process, advised that the inventor should protect it by patent, when they would be free to consider its mercantile value. Mr. Hancock in the meanwhile satisfied himself that the rubber was, as represented, unaffected by cold and heat, and that there was sulphur present in it. Here was a fact of immense value to an experimenter; the result, which he had been in search of for nearly twenty years, was no longer speculative, but before his eyes. "Finding," says our author, "now that this object appeared to have been somehow or other effected, and

therefore demonstrated to be practicable; and as it was my particular department to keep up the quality of our [Macintosh & Co.'s] manufactures, and to maintain our standing, and the position our goods had attained, I set to work in earnest, resolved, if possible, not to be outdone by any. * * * * The little bits given me by Mr. Brockedon, certainly shewed me, for the first time, that the desirable change in the condition of rubber, of not stiffening by cold, had been attained; but they afforded no clue to the mode by which it had been brought about. * * * I spent all my spare time for months with these experiments. * * * During the winter months I generally found the weather cold enough to test my scraps, but as the spring and summer came, I employed ice. * * * My experiments had now become very interesting: I had certainly produced in some of my scraps, or portions of them, that condition of rubber which I afterwards called the 'change.'" While yet ignorant of what it was in the successful specimens that produced the desired change, he applied for a patent for the discovery, trusting to further researches to clear away his difficulties. In the meanwhile, Mr. Charles Goodyear, of New York, with whom the vulcanizing process had originated, and who, in the person of his agent, had first made the fact known in this country, sought and obtained an English patent for his invention on the 30th January, 1844; whereas his rival had protected his discoveries, which were based upon Goodyear's demonstration, of the possibility of producing the change in rubber, two months before, or on the 21st November, 1843. This patent of Mr. Hancock's gave the house of Macintosh a legal monopoly of the india-rubber manufacture in England; for no sooner was vulcanizing introduced, than its advantages were generally acknowledged. Contemporaneous with the efforts made to improve the Macintosh goods, the licensees of Mr. Goodyear, in the United States, exerted themselves to rival each other in all classes of goods; and they very quickly extended the application of rubber, and completely surpassed the English manufacturers in many branches of the trade. The feeble efforts made here to manufacture rubber shoes were quickly discontinued, and America at once commanded the trade of over-shoes; paying however, a royalty to the English patentees. Some importers, however, of these and other goods, set Mr. Hancock's patent at defiance, and drew him and his partners into a costly series of lawsuits, which finally terminated in a compromise.

Early in the year 1851, Mr. Goodyear perfected and patented a very important improvement in the treatment of rubber. By this new process he was enabled to mould it to any required shape, render it hard, and impart to it a permanent polish. Here again was opened a new era for the india-rubber manufacture. Veneers of a lustrous black or mottled character could be produced, possessing the toughness

of bone. Handles of knives, combs, bracelets, pen-holders, walking-sticks, flutes, snuff-boxes, and a variety of other articles, produced by this process, were exhibited in the Great Exhibition, to the astonishment of all beholders; and to no one less, we will venture to say, than to Mr. Hancock. We now come to what we consider a most disingenuous part of the personal narrative, where our author takes to himself the credit of having originated this second great invention. A comparison of documents leads us to a very different result. In speaking of his patent of 1846, which was for "improvements in the manufacturing and treating of articles made of caoutchouc," he says:—"I may here mention that in this specification I described the hard or highly-vulcanized rubber as one of the materials of which I formed my moulds. Although the means of producing this hard material was described in my first vulcanizing patent of 1843, this was I think the first time the actual application of it to any particular purpose had been published." Now after a careful examination of this specification, which we must admit may, from its rambling and vague nature, mean almost anything or nothing in particular, as circumstances may dictate, we are at a loss to trace, in any passage, the faintest indication of the application of the hard rubber. And as respects its previous description in the specification of 1843, by reference to that document it will be seen that the patentee sets out as the object of his invention, to diminish or obviate the effects of cold and heat; and he then confines himself to explaining the mode of proceeding, to render the material permanently elastic. It is true that in dilating upon the effects of heat upon the compound of sulphur and rubber, he speaks of its nearly losing its property of stretching, and adds, "if carried still further, it turns nearly black, and has something the appearance of horn, and may be pared with a knife similarly to that substance." But this hint he evidently threw out to guard the experimenter against spoiling his work, and little thought he was on the threshold of a great discovery. It appears, however, from the narrative, that he has made good use of the invention, and has supplied the hard rubber by the ton to comb makers, who employ it in place of horn and tortoiseshell. Another improvement which Mr. Goodyear introduced about this time was the formation of articles, partly of soft and partly of hard rubber. Very little has yet been done in this branch, but we have recently seen some very ingenious applications of this happy idea.

The difficulty which was presented to Mr. Hancock in the introduction into this country of rubber in its liquid state was removed by a very simple expedient, the invention of Mr. Henry Lee Norris, of New York, for which he obtained an English patent, dated February, 1853. The fluidity was preserved by simply adding concentrated liquor of ammonia to the juice, as it exudes from the tree. We have not yet heard of the application of this very singular substance to the arts; but as a cement,

and for waterproofing the most delicate tissues, it stands unrivalled. Among those who have been most active in advancing the rubber manufacture, Mr. Horace Day, of New York, stands prominently forward: and it is chiefly through his exertions and those of Mr. Goodyear, that we may expect further advances in this interesting branch of manufacture. The next problem that requires to be solved, is the re-conversion of vulcanized scrap rubber. Many attempts have been made to attain this end, so as to utilize the worn out over-shoes and waste pieces of cured rubber, but only, as far as we are informed, with very imperfect results. A material termed, from its porous character, rubber sponge, has been made both here and abroad, and used chiefly for packing; but a new and very ingenious application of it, recently brought to our notice, induces the belief that its use will, ere long, become very much extended. This substance, Mr. Hancock tells us, was discovered at an early period of vulcanizing: it is not improbable that it came out as one of the unexpected and unwelcome results which constantly dog the steps of the experimenter in physical science.

We have thus traced, in a hasty manner, the progress of Mr. Hancock's personal experiences, as made known to us by his pen; and we have touched upon the labours of others who have assisted in advancing the rubber manufacture, with a view of shewing in a clearer light his relation to the manufacture. In summing up his merits, we consider his claim, as an inventor, rests solely upon the masticating or reducing process. That he has shewn great diligence throughout his long career cannot be doubted, but that his labors in the re-discovery of the vulcanizing or curing process were of benefit to any but himself and his immediate friends, we must deny, for the public would certainly have received it from the inventor in as perfect a state and at as early a period, if he had never addressed himself to the subject. Indeed it is more than probable that the manufacture of cured rubber goods would have equally progressed in England and America, had the original inventor been allowed free scope here to develop his improvements. That he was cramped in his efforts is due to the still imperfect state of our patent law, which, unlike the American law, does not recognize the indefeasible right of the first inventor. Had his patent taken precedence of Mr. Hancock's, which, under the circumstances, it ought rightly to have done, we should, doubtless, have had the experiences of the American manufacturers instead of their goods imported into this country. But now that the vulcanizing patent is on the eve of expiring, we may look confidently forward to a great expansion of, and the introduction of important novelties into, this interesting branch of industry.

To CHARLES WEIGHTMAN HARRISON, *of Woolwich, for improvements in metal ropes, cables, and rods, and in machinery for manufacturing the same.*—[Dated 26th May, 1855.]

THE first part of this invention consists in forming ropes and cables solid or hollow, of a number of angularly-shaped plates or strips placed together side by side upon a core and parallel therewith. Each of these strips, in its transverse section, forms a sector of a circle, the angles of two of its opposite sides being either radial lines from a centre or central core, or forming a tangent thereto. Around the strips so placed, is laid, either spirally or otherwise, a coating of felt, or some other suitable fibrous material; and to preserve the metal strips from oxidation, such covering is saturated with tar, marine glue, or other compound of a similar nature. Upon this covered core, wire or flat metal ribbons, or rectangular metal strips are wound, but in general one or two narrow flat ribbons or sheets are preferred for this purpose, so as to form spirals approaching to a right angle with the axis of the core. The central core may either consist of a strand of wire, or strips or a pipe of metal, gutta-percha, caoutchouc, or of other suitable flexible substance; or it may be a core of insulated conducting wire, adapted for electric communication; or a rope, or strands of hemp, cocoa-nut fibre, or other like material.

In Plate III., fig. 1, represents a perspective view of an electric telegraph rope or cable constructed on this principle. *a*, is the central core of insulated wires; *b*, the angular parallel strips; *c*, the coating of felt; and *d*, the spiral flat ribbon wrapper. It will be seen that in this rope or cable every strip is laid entirely free from twist and in exact parallelism one with another, so that each bears its true proportion of strain to resist fracture under tension; whilst from the peculiar shape of the strips they give to the rope or cable all the strength of a cylinder of equal size. In longitudinal strains the strips bear with their broadsides against each other, and cannot slip inwards, as wires, when laid in a rope, and only touching at a point of their surface, are liable to do; thereby throwing the strain on the central core of conducting wire; and in like manner, under pressure, they offer the strongest resistance against injury. The rope or cable, too, being formed, without torsion, of perfectly straight strips, it has less tendency to double or kink in passing up from the hold of a ship during the process of laying down, and thus in a great measure are avoided the interruptions which it is well known have frequently endangered the safety of the ordinary twisted submarine telegraph cables. By laying the parallel strips around a pipe or tube, and binding them together in the manner hereinbefore stated, a hollow rope of great strength and durability is formed. When the rope is laid round a leaden or other pipe intended for conveying liquids, a coating of felt or other suitable material is sometimes interposed between the pipe and the strips, or between the strips and spiral wrapper, or between both of these. Hollow ropes, so formed, will not be liable to burst from the effects of frost, as is the case with ordinary pipes, and being exceedingly flexible, are readily laid down in any entire length. Separate lengths of these ropes or cables, both solid and hollow, are connected together by means of a socket made in two parts, with a flange on the sides of each, through which they are bolted or screwed one to the other. The interior of the socket is formed with suitable projections which fit into grooves cut around the parallel strips

near the end of each rope, between which a projection also meets closely around the united part of the central core. Figs. 2, and 3, are longitudinal and cross sections of one of these joints. *a*, is the central core; *b*, the parallel strips; *c*, the spiral wrapper; and *d*, the socket bolted together through the flanges *e*. By using branch or V sockets provided with suitable cores, instead of these straight sockets, a number of ropes or cables may be made to communicate with each other, in a manner similar to that effected with cast-iron pipes.

The second part of the invention relates to that description of metal rope which is formed by laying or coiling two or more layers of wires in opposite directions one over the other; and the improvements consist in constructing such ropes of flat metal in the form of ribbons or narrow sheets, instead of wires, as hitherto done, whereby a close and uniform covering is formed around the core to defend it from injury, which it is well known is not afforded by an ordinary metal rope of this kind, by reason of the interstices between the wires. Both solid and hollow ropes are formed by this plan, and a single ribbon to form a layer is used, and sometimes more; but when a very flexible rope is desired, not more than two ribbons are preferred, in order that the spiral convolutions may be laid short. By this means a metallic wrapper is formed, in which security is combined with great flexibility. To protect the rope from decay a fibrous coating is interposed between the layers of ribbon saturated with a suitable adhesive composition, as hereinbefore described with reference to the first part of the invention. Fig. 4, represents a perspective view of a hollow rope formed in this manner; *a*, is a gutta-percha tube; *b*, the metal ribbons; and *c*, the intervening fibrous covering. By substituting for the hollow tube a core of insulated wires, a flexible telegraph rope is formed, very suitable for subterraneous communication, without the use of pipes or troughs, a process which is attended with much trouble and expense. It is well known that in streets and roads wherein gas-pipes are laid, the soil is generally impregnated with carburetted gases, and that such are injurious to the insulating material: to obviate the ill effects of these, the core of the rope in which they are contained is enclosed in a pipe or tube of lead or other flexible metal previous to winding around the metal ribbon, and either with or without an intervening fibrous wrapper, as hereinbefore described, or insulated wires separately covered with lead are laid in the core. It will be understood that this highly flexible telegraph rope is not intended to resist any great strain, and is only adapted for underground purposes. When, however, it is desired to form a telegraph rope or cable of equal or nearly equal flexibility, and capable of sustaining considerable tension, without injury to the conducting wires, a strand or several strands of wire are enclosed in the core, and insulated wires, wormed or surrounded with hemp, are placed in the intervening spaces between the strands. These strands are either laid side by side in the core without twist, or the core is formed by laying or twisting the strands and insulated wires together, in the manner of a common wire rope; but instead of applying an equal or nearly equal degree of tension on the strands and insulated wires during the process of twisting or laying them spirally together, as in the ordinary mode of construction, great tension is put on the wire strands, and very slight tension on the insulated wires. By this means the insulated wires will readily yield without injury in any case of strain to which the rope may be subjected; whilst the strands

being incapable of yielding, are made to bear the entire tensive force. Around cores so formed, and surrounded, when desired, with a fibrous covering, are wound one or more layers of spiral ribbons, as hereinbefore stated.

The third part of the invention refers to the construction of metal rods, both solid and hollow, which are formed as follows:—A sufficient number of angular plates, each of which in its transverse section forms a sector of a circle, so as to form a cylindrical core or rod, are placed together side by side and parallel with each other, around which is wound wire ribbon or strips in close short spirals, and the rod, thus prepared, is passed through a bath of molten zinc, or other metal or alloy of metals, whereby the convolutions are firmly united with each other. Rods may also be constructed without a spiral wrapper by tapering or chamfering the outer edges or corners of the plates, and drawing them, when placed together to form a rod, through suitably-sized dies or tubes, part or parts of which are immersed at a short distance from each other in a bath of molten metal (as hereinbefore described), through which the rod is drawn.

Fig. 5, is a cross section of a hollow rod formed in this manner; the angular spaces shewn around the circumference being filled up with zinc or other metal in the passage of the rod through the bath; by which the strips are united into a solid smooth galvanized rod of great cohesive power.

Lastly, the invention relates to certain improvements in machinery for manufacturing metal ropes, cables, and rods, whereby wires, strips, or plates are laid, as hereinbefore described, without individual torsion, in exact parallelism one with another, and bound together by spiral coverings or wrappers, formed of equal or different breadths of ribbons, with intervening coatings of hemp, felt, or other fibrous material; the entire operation being completed simultaneously and with facility.

Fig. 6, represents an elevation of the improved arrangement of machinery. *a*, is a driving pulley, which by means of the bevilled cog-wheels *b*, b^1, communicates rotary motion to the shaft *c*, working in the bearings *j*, *j*. Upon this shaft a number of conical pulleys *d*, *d*, are fixed in suitable positions, for driving the frames or discs carrying the bobbins or reels containing material for forming the spiral wrappers. As each of these parts of the machine is similar in form and arrangement, only one of them is shewn in the figure. *d*, is the conical pulley on the shaft, connected by a band with another like pulley inverted on the hollow axis *e*, of the frame or disc *f*, which carries the reels *g*. The axis *e*, is held in position by sockets fixed on the cross bearings *h*, h^1, attached to the main supports *i*. *k*, is a reel, having a free axial motion on the standards *m*, fixed on the bed *l*, of the machine, and immediately under the hollow axis of the disc *f*. Upon this reel the material intended to form the inner core of the rope or cable is wound. On the standards *o*, revolve the reels *n*, containing the strips or plates which are to be laid in the rope or cable and parallel to its axis. Only two of these reels, forming a circle of twelve, are represented in the figure. *p*, is a double cone or plate, fixed on the cross-bearing *q*, through suitably-formed apertures, in which the plates or strips are drawn, and thereby prevented from turning over or becoming twisted.

Fig. 7, is a plan of this double cone or plate. On its inner part *r*, grooves are cut suitable for the passage of the strip employed, which is

retained therein by the outer part *s*, being placed over, and the two secured together by bolts or screws *t*. Each strip as it passes through a separate hole in the cone is carried into the funnel-mouthed tube *u*, secured to the bearing h^1, wherein they are brought together to a cylindrical form, and conveyed thus through the hollow axis of the frame *f*; on emerging from which they are covered by the spiral wrapper supplied from the revolving wheels *g*; the grooved pulleys u^1, holding the rope in a central position between the standard guides *v*, during the process. The rope or cable is then carried forward to pass through other similar arrangements, and thereby to receive as many additional spiral coverings as may be necessary. By alternately crossing the straps or bands connecting the conical pulleys, each successive spiral covering is laid in an opposite direction to the preceding one; and by altering their position on the pulleys the speed of the frames or discs is varied to lay at pleasure both narrow and broad ribbons, wires, strips, or sheets of covering material around the rope or cable at one operation. Instead of using cones or plates, as just described, for the purpose of preventing torsion, antifriction rollers are sometimes employed.

The reels *g*, are mounted on a frame or disc to revolve in a parallel plane,—the freedom of their motion being regulated by bow springs and lock nuts, so as to keep an uniform strain on the covering material. The rope or cable, as manufactured, passes over a large pulley placed in any suitable situation, and thence around a drawing drum, which is connected by a wheel and pinion, as shewn at *x*, x^1. This arrangement being similar to that provided in ordinary metal-rope machines, and well known, it is not necessary to explain.

The patentee's claims are, "First—the employment of angular metal plates, strips, or ribbons, in the construction of metal ropes and cables, when such plates strips, or ribbons are placed together side by side, parallel with the axis of the rope or cable, as hereinbefore described. Second,—the construction of hollow ropes and cables, formed by laying or winding wires, plates, strips, or ribbons of metal upon or around a hollow flexible tube or pipe, as hereinbefore described. Third,—the employment of metal ribbons or sheets of any proportions or dimensions in the construction of that kind of metal rope which is formed by successive layers of opposite spirals,—the use of ribbons or sheets for such purpose being attended with peculiar advantages, as hereinbefore described under the second head of this my specification. Fourth,—the employment in the construction of metal ropes and cables for electric communication, of insulated conducting wire, inclosed in a tube or pipe of lead or other flexible metal, as hereinbefore described. Fifth,—the mode of manufacturing metal rods, both solid and hollow, by employing any number of metal plates or strips of the form and in the manner hereinbefore described. Sixth,—the mode, hereinbefore stated, of connecting or joining together separate lengths of ropes or cables constructed as described in the first part of this my specification. Seventh,—the method of twisting or laying spirally together strands of wire and insulated conducting wires in telegraph ropes or cables, by placing a much greater strain or tension on the wire strands than on the insulated conducting wires during the process of manufacture, as hereinbefore described. And, eighth,—the machinery for manufacturing metal ropes, cables, and rods, hereinbefore described, in so far as regards the mode of preventing metal plates, ribbons, strips, or sheets from becoming

twisted in themselves, by passing them through angular-formed grooves or holes in plates, cones, or antifriction rollers, and the mode of varying the speed in the motion of the discs, so that different breadths of materials may be simultaneously employed to form spiral coverings in or around a rope, cable, or rod."

To SAMUEL STATHAM, *of Cloudesley-street, and* WILLOUGHBY SMITH, *of Hoxton, for improvements in electric telegraph cables, or cores for the same.*—[Dated 15th August, 1855.]

THIS invention consists, firstly, in laying one or more wires, flat, circular, or of any other desired shape, spirally round a core of fibrous material coated with an insulating material, or round or upon a core of gutta-percha, or other suitable insulating material, with or without a conducting wire in the centre, and in insulating such wires so laid upon a core by as many successive coatings of gutta-percha, or other suitable insulating material, as may be necessary. The wires are either laid upon or round the core while wires and core are in a cold state, or heat is applied in order to cause the wires to become embedded in the core; or one or more wires are woven into a cloth or braid, which is coated or not with insulating material, and laid on a core, and then any suitable insulating material is applied on the outside thereof.

In Plate III., fig. 1, is an external elevation of a telegraph cable, with parts removed in order more clearly to shew its construction. The inner core *a*, consists of gutta-percha, or other insulating material, round which three wires are laid spirally. This core and wires are coated and insulated by one or more coatings of insulating material, which are again surrounded by six wires, laid spirally, as shewn at *b*: these wires are again covered with insulating material, on which wires formed into a tape or braid, or sets of wires placed side by side, are again laid, as shewn at *c*; or they may be laid separately in any required number, as at *b*. These latter wires may be of iron, when they will afford additional strength to the cable. One or more coatings of insulating material is then again applied, and the cable or core is brought into the form shewn at *d*. Either of the parts *a*, *b*, or *c*, with an outer coating or coatings of insulating material, may be used separately as a cable, or core for a cable. Fig. 2, is a longitudinal section, and fig. 3, a cross section, of a cable, or core for a cable, containing in a small diameter thirteen wires, completely insulated from each other. Six wires, each covered with a coating of insulating material, are laid spirally round a similarly coated wire, which serves as a core for these six coated wires; and in the interstices left between the six covered wires six other wires are laid, and the whole is insulated by applying outside thereof one or more coatings of gutta-percha, or other insulating material.

Secondly, the invention consists in an improved means of joining electric telegraph conductors, by making the present form of joints more secure than they now are. Joints are ordinarily made by coiling a piece of wire round the ends of the two wires to be united, and by brazing or soldering the whole together throughout the entire length of the joining piece. Now, in addition to this joining piece a second lapping of wire is added, which is coiled round the joint, united as above, and the second lapping is

only brazed or soldered at the two ends thereof,—the second lapping always extending beyond the first. Fig. 4, is a representation of two wires united by a joint, as now generally made, formed by a wire lapped and brazed or soldered over the ends of two wires to be united; fig. 5, shews the improved joint; and fig. 6, shews one of the joints insuring continuity after an ordinary joint has given way.

The patentees claim, " First,—the construction of electric telegraph cables, or cores for cables, by laying one or more wires spirally round a core of insulating material with or without a wire therein, or of fibrous material covered with insulating material, prior to such wires receiving their final insulation. Secondly,—the construction of electric telegraph cables or cores, by adding to a cable or core, formed as first claimed, successive alternate layers of wires and insulating material, in the manner hereinbefore described. And, Thirdly,—the improved joint, hereinbefore described."

To SAMUEL STATHAM, *of Islington, for improvements in electric telegraph cables.*—[Dated 18th October, 1855.]

THIS invention consists in producing a telegraph cable, light, flexible, and strong, applicable for submarine as well as for subterranean purposes, in the following manner:—A core of gutta-percha, or other insulating material, containing therein one or more metallic wires, strips, or plates, used for conducting the electric fluid, is first prepared, and around the core are laid strands of hemp or cord, or a tube of any suitable fibrous material, or metallic wires or strands covered with fibrous material, or both wires or strands and fibrous material. The encased core is then covered by an outer casing or tube of gutta-percha, or any of its known compounds.

By this means the patentee states that he is enabled to produce a light, flexible, and strong cable, especially suited for submarine purposes, in which the weight may be regulated by the employment of metal wires, strands, or plates, or fibrous materials, between the insulated wire or wires and the outer coating, as well as by the employment of gutta-percha, or any of its known compounds, alone, or by combining with either of these, more or less, some suitable substance heavier than gutta-percha itself, with the gutta-percha or gutta-percha compounds employed for the outer casing.

He claims " the forming of electric telegraph cables in the manner hereinbefore described."

To LEWIS DUNBAR BRODIE GORDON, *of Abingdon-street, Westminster, for an improvement in electric telegraphs when insulated wires are laid under water or in the earth,—being a communication.*—[Dated 15th September, 1855.]

IN sending telegraph messages through long submarine or underground conductors, considerable practical inconvenience has been experienced in consequence of the time which elapses in the passage of each current of electricity from the battery to the receiving instrument at the extremity of the metallic conductor. In removing the battery from the electric circuit, the current subsides gradually at the opposite end of the submerged conductor; and, consequently, currents that follow each other with rapidity

merge into one continuous stream, and cease to work the receiving instrument; and when several insulated wires have been combined into one cable, hindrance has been experienced in working through these several conductors simultaneously, in consequence of the volta induction produced by the one upon the others.

The object of this invention is materially to reduce or entirely to obviate the charge and volta induction, and to provide means of transmitting telegraph messages through greater lengths of submarine cables and underground conducting wire than could hitherto be effected with a sufficient degree of certainty and rapidity.

The invention consists chiefly in using a set of two insulated wires, as shewn in Plate III., fig. 1, placed in close proximity to each other, and imbedded in the middle of one mass of gutta-percha or other insulating material, as one electric circuit, in which the battery and receiving instrument are inserted, without using the earth as part of the circuit. The two conducting wires will be charged equally at any given point,—the one with positive and the other with negative electricity; and since both of them are in equal proximity to the surrounding water or earth, it follows that no electric charge can take place between the wires and the earth; nor will any induced current be produced in additional conducting wires that are imbedded in the same conducting mass, provided they are placed equidistant from two wires forming the electric circuit.

The same cable may therefore contain one or more sets of insulated wires, as *a*, *a*, and *b*, *b*, in fig. 2, in close proximity to each other, which may be used simultaneously as circuit, without the interference of one with the other. But in order to render the electric waves succeeding each other still more separate and distinct, the communicating instrument is arranged in such manner, that each positive wave is followed immediately by a negative wave, that may be produced by reversing for an instant the poles of the battery employed before breaking the circuit.

If an electric cable is to contain only a single pair of conductors to form a circuit, it is sometimes preferred to insulate one copper wire by a covering of fibrous material; it is then covered with iron or copper wires close to each other (and of a conducting capacity equal to the central wire), which in their turn are covered first with fibrous material, and then with gutta-percha or other plastic insulating substance. The copper wire is employed to convey the current in one direction, and the iron wires for the return current, and so complete the circuit without making use of the earth, as at present practised.

The patentee claims, "First,—the manufacture of electrical conductors, by placing two wires, or sets of wires, insulated from each other by fibrous materials in the middle of one mass of gutta-percha. Second,—the using two insulated wires, placed in close proximity to each other, and imbedded in the middle of one insulating mass, as one electric current, as described. Third,—the sending reverse currents through the circuit of two wires arranged as described. Fourth,—the manufacture of double metallic conductor cables, as described. Fifth,—in using a cable formed of one copper wire, insulated and covered with iron or copper wires, which are surrounded by fibrous material, and then with gutta-percha, or other insulating substance, as one electric circuit, as described."

To Pier Alberto Balestrini, *of Brescia, Italy, for improvements in protecting and laying telegraphic wires.*—[Dated 11th September, 1856].

In order to protect telegraphic wires for submarine and other communication, the inventor insulates them by gutta-percha, or vulcanized india-rubber, or incloses them in cords of hemp, or other fibre rendered waterproof by a mixture of india-rubber and pitch. The wires, thus protected, form the core of the telegraphic cable; and they are either laid parallel to each other, or they are laid spirally on a core of fibre, or of iron wire covered with fibre. Eight or other number of cords of hemp, or other fibre, waterproofed with the composition before mentioned, are then closely wound in a spiral direction round this core, and the cable so formed is consolidated by passing it between grooved rollers. If the cable is intended for use under a considerable depth of water, it is strengthened by coiling round it (in the opposite direction to the coils of the cords) iron wires in long open spirals, and over these wires the cable is wound round closely with galvanized iron wire; and by the action of the wire a calcareous deposit is produced round the cable, after it has been immersed some time, by which it is much protected. Sometimes, with a similar object, strips of zinc are laid longitudinally along the cable under the wire coating. In places where the cable is likely to come in contact with rocks, it is protected by having steel wire wound round it. To facilitate the laying of the cable, a description of parachute is attached to it at intervals, which parachute is so arranged, that when the cables enter the water, the parachute opens, and prevents the cable from being drawn violently through the water. To protect the wires, to be used suspended from posts or otherwise, they are enclosed in cords of hemp or other fibre, waterproofed with the composition before mentioned, and afterwards painted with zinc white.

In Plate III., fig. 1, shews a side view and section of the core of a cable intended to be immersed at a slight depth,—the covered wires forming the core being laid parallel to each other; but when the cable is intended to be immersed at a great depth, the covered wires are wound spirally around a small cord or curved wire, as at fig. 2, or around an iron wire covered with hemp or other fibre, as at fig. 3. These cores are then surrounded with hemp, or other fibre rendered waterproof, as shewn at figs. 4, where the core has twisted around it eight cords, each composed of four strands. The cable thus made is then passed between grooved rollers, so as to compress the cords around the core, and prevent it from stretching when being laid down. The cords twisted around the core are rendered waterproof in the following manner:—Raw caoutchouc is melted in a pan, heated by a well-regulated fire, until it is of the consistency of thick oil, when more and more caoutchouc is added: a quantity of pitch equal in weight to the raw caoutchouc employed, is then well mixed in. The cords may be saturated with this composition, either by placing them in the composition and subjecting it to pressure, or by passing the cord through a series of heated pipes filled with the composition,—each pipe being terminated by a conical gutta-percha tube, which scrapes off the excess of the composition. The cable thus made is then stretched, and bound round closely with iron wire; strips of zinc being placed horizontally between the coating of wire and the cable, which gives rise to a chemical

and electrical action, which keeps the outside coating from rust, and produces a calcareous deposit, by which it is much protected.

If the cable is to be immersed to a considerable depth, long open spirals of iron wire are placed between the cable and its covering of galvanized wire, as shewn at fig. 5, the spirals running in the opposite direction to the coils of the cord. The iron wire composing these spirals not being galvanized, the same action takes place between the galvanized and non-galvanized wire, which preserves the cable until the calcareous deposit is produced. In places where the cable is likely to come in contact with rocks, it is protected by steel wire wound round it. Fig. 6, shews a side view of the parachute employed for facilitating the laying of the cable in its closed position; and fig. 7, is a section of the same when open. These parachutes are formed, by preference, of double sail cloth, cemented together by caoutchouc, and formed into a cone, the top of which is firmly fixed to the cable, and at the bottom of the cone there are a number of ropes attached, which are also fixed to the cable. When the cable is coiled up, these ropes are doubled up in the parachutes, and the parachutes are folded around the cable; but when the cable is lowered into the water, these parachutes open, and by their resistance to the water, they prevent the cable from descending too rapidly. In certain cases, when the parachutes would not be suitable, floats may be attached to the cable at short distances from each other, by means of a connecting apparatus filled with any substance soluble in water, and thus capable of releasing the float a short time after the cable enters the water.

To protect wires to be used suspended from posts, or for military or other purposes, they are enclosed in cords of hemp or other fibre, water-proofed with the composition, and in the manner above mentioned, and afterwards painted with zinc white.

To Robert Stirling Newall, *of Gateshead, for improvements in apparatus employed in laying down submarine electric telegraph wires.*—[Dated 14th May, 1855.]

This invention consists of apparatus combined and acting in the following manner:—The cable or rope containing the insulating wire or wires is passed round a cone, or, if it is a long cable, round several cones, so that the cable, in being drawn off the coil, is prevented from kinking by means of the cone, and there is a cylinder on the outside which prevents the coil from shifting in its place. The cable passes over a pulley above the cone and on to a break-wheel, round which it takes several turns to obtain sufficient holding, and from the break-wheel it passes over the stern of the vessel on board which the cable or rope is placed; or two or more break-wheels, the one behind the other, may be used: the cable or rope comes up from the hold of the vessel and round the first break-wheel several times; then on to the second break-wheel, round which it also takes several turns. When the break is applied to the first wheel it increases the friction on the second, and so on, according to the number of break-wheels used; or two break-wheels, coupled together either by spur gear or cranks and connecting rods, may be employed: the cable in such cases passes round only a part of the circumference of each. There are grooves in the wheels which guide the cable or rope from one to the other, and prevent

its getting foul; or a guide is used to push the cable from one side of the wheel to the other, so as always to keep one part from riding over another. The greatest difficulty in laying down submarine telegraph wires or cables hitherto has been the limit to speed in paying them out, arising from the necessity of the leading off part of the coil being kept clear of the others, by a great number of men handling it to prevent its getting into kinks or becoming entangled one part with another. This is remedied by coiling the wire or cable round a cone (or several cones if required), so that the wire in being drawn off the coil is prevented from kinking by means of the cone. The figure in Plate III., is a section of the improved apparatus employed for this purpose. *a*, is the cone, formed of wood, or it may be of iron, presenting an even surface on the outside, so that the wire in passing round it may not be caught by any projection. This cone is firmly fastened to the bottom of the vessel, and reaches at least as high as the top of the coil. Around the cone is formed a cylinder or series of uprights *m*, strongly fastened to the bottom and deck, so as to prevent the coil of wire or cable which is coiled around the cone from shifting in its place. A strong iron ring or hoop is fastened outside the supports to brace them together at *n*. Over the cone is placed a pulley, one side of it being in a line with the axis of the cone.

At a convenient distance between the cone and the stern of the vessel is placed either one or two break-wheels, depending on the weight of wire or cable hanging over the stern, and the power of the break-wheel (which must be sufficient to prevent the cable from running out when the ship or vessel is passing over the greatest depth of water); so that by easing the break, the wire may be paid out at the same speed, or nearly so, as the vessel is passing over the ground. The diameter of the break-wheel should be about eight or nine feet, and arranged in a framework, as shewn. The cable is carefully coiled round the cone in horizontal layers, beginning from the outside next the cylinder and coiling towards the cone. When the space is filled up, the bight of the rope is taken to the outside of the coil, and another layer is coiled, and so on, until the whole length is coiled round the cone.

When the wire or cable is to be laid down, over the cone an apex or top is placed, which is conoidal or conical, and around this several rings of iron or other metal are suspended by means of cords, so as to admit of adjustment at various heights over the cone, as at *c*. The use of these rings is to prevent the bight of the rope from flying out when going at a rapid speed; and the combination of these parts of the apparatus prevents the wire or cable from running into kinks. The two rings nearest the coil are lowered, so as to be about six inches and a foot, respectively, above the coil as it is being paid out.

When the wire or cable is to be paid out, the end is led up through the rings over the pulley and round the break-wheel; or if two break-wheels are used, it is led round the first one several times to obtain adhesion, then round the second and over the stern of the vessel to the shore, where it is made fast. The vessel then goes ahead, and the wire is drawn from the coil,—sufficient friction being applied by the handle of the break-wheel or wheels to keep the wire or cable tight.

The patentee claims, "First,—coiling the wire or cable round a cone. Second,—the supports placed cylindrically outside the coil round the cone. Third,—the use of rings in combination with the cone, as described."

To JULES LALEMAN, *of Lille, in the Empire of France, for improved machinery for combing flax and other similar fibrous materials,—being a communication.*—[Dated 20th August, 1856.]

THIS invention relates to a novel method of actuating the flax-holders which hold the stricks of flax while under the operation of the comb teeth of the working cylinders, and consists in connecting or attaching such flax-holders to an endless chain, band, or strap, which is passed in a serpentine direction round a series of pulleys or drums, to which motion is communicated from the driving-shaft of the machine by means of suitable gearing. The endless chain, band, or strap, with its flax-holders suspended therefrom, works horizontally along or above the comb-drums or working cylinders, of which there may be one, two, or more; and the combs thereon are made finer at one end of the cylinders than the other, and the teeth of the different cylinders may be of different degrees of fineness. By this arrangement the flax-holders may be moved forward in a continuous and regular manner from end to end of the machine, whereby a good yield of flax, without injuring the quality of the fibre, is obtained. The flax-holders also may be brought so close to the working cylinder as almost to touch, whilst in the machinery now in use they cannot be brought within a considerable distance, comparatively, in consequence of the excentrics and other working parts connected with them.

In Plate IV., fig. 1, is a plan view, and fig. 2, a side elevation, of a series of flax-holders mounted and working upon the improved plan. *a, a,* is the endless moveable chain which carries the flax-holders; *b, b,* are the flax-holders, which are suspended from or attached to this endless chain *a,* in any suitable manner. The chain is moved horizontally in a serpentine direction round the pulleys or drums, 1, 2, 3, 4, 5, 6, 7, 8, and 9, as shewn in the plan view, and thereby carries the flax-holders over or along the surface of the several combing cylinders in succession. The flax-holders, when filled with a strick of flax, are suspended from the chain at a point somewhere near the pulley No. 1; and as the gauge of the comb-pins of the cylinders increases in fineness successively, the more remote they are from the pulley No. 1, it follows that, as the holders, with the flax hanging therefrom, are conducted through the machine in a serpentine direction, the fibres will be first opened by the coarse teeth of the first comb cylinder, and then operated upon by finer and finer teeth until the flax is perfectly combed, by which time it will have arrived at the pulley or drum No. 9, and will be carried round in front of the machine, when the holders may (as they arrive) be taken off the endless chain *a, a,* for the purpose of having the flax changed, when they may be placed on the chain again, near the pulley or drum No. 1, and passed a second time through the machine.

The patentee claims, "the use and application to machinery for combing flax and other similar fibrous materials, of endless chains, bands, or straps, from which the flax-holders may be suspended, or to which they may be attached, for the purpose of being conducted to the combing cylinders and through the machine, as above described."

To ROBERT BROWN, *of Glasgow, for improvements in taps or valves.*—[Dated 25th September, 1856.]

THIS invention relates to an improvement in the construction of taps or valves, to be applied to pipes or passages for supplying water, or for the transmission of a fluid of any kind. The improvement is more particularly designed for application to the float and lever-tap, by means of which water-cisterns are supplied, and is intended to render such taps less liable than hitherto to get out of order, whilst it is also applicable in other situations.

In Plate IV., fig. 1, is a vertical longitudinal section of the shell or case and branch thoroughfares of one arrangement of the improved taps or valves,—the weighted lever, its attachment and guide, and a portion of the valve, being shewn complete. Fig. 2, is a vertical section of the shell and branch passage of another arrangement of a tap or valve, as fitted with an adjustable lever and ball-float, which are represented complete. Fig. 3, is a plan, partly in section, of a tap adapted for the service of water in dwelling-houses; and fig. 4, is an elevation, partly in section, of a valve suitable for discharging water or other fluids from cisterns, tanks, or reservoirs. In the improved tap or valve, shewn at fig. 1, the water passes through it in the direction indicated by the arrows. The shell or chamber of the tap *a*, is cast or made with a horizontal waterway or passage through it, and with a vertical aperture, in which the tubular valve *b*, is fitted. The lower end of the valve *b*, passes through an opening, made in the horizontal part or acting valve-face *c*, of the waterway, and terminates in a screw *d*, over which is placed a washer or ring *e*, of vulcanized india-rubber, leather, or other suitable material. This washer is retained in its place by a metal cap *f*, which is screwed on to the spindle *d*, of the valve, and serves to keep the washer *e*, in close contact with the horizontal part *c*, of the tap, which thus forms the valve-seating. In the lower part of the tubular portion of the valve *b*, are cut four or other suitable number of slots or apertures *g*, which may be arranged in two rows, one above the other, as shewn. The valve *b*, is actuated by a lever *h*, supported on a forked arm *i*, which projects from one side of the tap *a*, and passes through a slot formed in the upper part of the valve *b*. To the longer arm of the lever *h*, is attached a wire, chain, or other suitable means, by which the lever may be depressed: at the shorter end of the lever is a counterbalance weight, by means of which the valve *b*, is kept up to its seating *c*, when not acted upon through the wire or chain. When the lever *h*, is depressed, the valve *b*, is forced downwards; and this action brings the upper row of slots or apertures *g*, in a line with the inlet waterway, whilst the lower row is below the opening in the part *c*,—the water therefore rushes through the upper opening from the inlet through the tubular portion of the valve, and away by the lower apertures to the outlet passage of the tap, as indicated by the arrows. The arrangement and construction of this tap renders it particularly applicable for the supply of water to baths, and for other domestic purposes.

In the arrangement shewn at fig. 2, the valve is actuated by a lever and float acting against the pressure of the water, which in this modification tends to keep the valve closed. The waterway or passage through the body of the tap *k*, forms a right angle, or, in other words, passes along a horizontal line, and then downwards in a vertical direction. The valve *l*, is

tubular, and very similar to that hereinbefore described, and is fitted within the vertical part of the shell of the tap. On the upper part of the valve is placed a washer *e*, which is secured by a flanged cap *d*. The slots or apertures *g*, for the passage of the fluid through the tap are made just below the cap *d*. The valve-washer *e*, rests on the lower surface of the horizontal portion of the tap, and closes up the aperture of the vertical passage: the pressure of the fluid in this arrangement of the tap tends to keep the valve down upon its seating. The valve *l*, is raised by means of a lever *m*, which turns on a pin passed through the lug *n*, projecting from the side of the tap *k*. One end of the lever *m*, has upon it three or four rack teeth, which take into two or more teeth made on the lower part of the valve *l*. When the lever *m*, is depressed, it turns upon the stud-pin in the lug *n*, and this action causes the teeth on its inner end to act upon those on the lower part of the valve, and thereby raise the valve *l*, so as to bring the slots *g*, on a level with the horizontal waterway,—the water passing through the slots and down the vertical passage in the centre of the valve-piece *l*.

In the modification shewn at fig. 3, the water is shifted by means of a pin, which travels in a groove in the shell. The valve *o*, shewn in this figure, is attached to a curved pipe *p*, the raising or depressing of which turns the water on or off, as required. The valve *o*, is similar in its construction and arrangement to that shewn in fig. 2, excepting in the means by which it is turned round its axial line. In this case, a spiral groove *r*, is made in the middle of the tap *q*, at one end of the horizontal passage or waterway. The valve *o*, has a pin *s*, projecting from its side, and this pin travels in the groove *r*, when the outlet-pipe *p*, is turned upon its axis. The outlet-pipe *p*, is curved at its upper part, and is attached to the valve *o*. Upon turning the outlet-pipe upwards, so as to place it in a vertical position, the pin in the valve *o*, travels along the inclined plane of the spiral groove *r*, and this motion opens the valve to the position shewn. On the contrary, when the pipe *p*, is turned downwards, the valve *o*, is screwed out against the face *c*, and the slots or apertures in the valve are then opposite the sides of the passage, which is consequently closed. In this arrangement or construction of tap the pressure of the water acts upon the upper side of the valve, tending to keep it down upon its seat.

The fourth modification of the improvements in valves is shewn at fig. 4, which is an elevation, partly in section, of a valve, suitable for discharging water or other fluids from cisterns, tanks, or reservoirs. The short metal tube *t*, is fitted in an aperture made in the bottom of the cistern or tank, and is soldered or fitted thereto round the flange made near the upper part of the tube. The valve *u*, is of a tubular form, and the lower part of it slides freely in the pipe or tube *t*. The upper part of the valve-tube is cut away on each side, forming two slots or apertures, through which the water or other fluid passes to the outlet. A washer or ring *e*, of india-rubber, leather, or other suitable material, is fitted under the cap of the valve, which rests upon the upper edge of the tube *t*, and thereby closes the passage. The valve is raised by means of a wire, chain, or other suitable attachment; and when lifted, as shewn, the water or other fluid flows off, through the slots or apertures made in the valve-tube.

The last part of the invention relates to an improvement in regulating or adjusting the leverage of floats, by which taps or valves are made self-acting, and is shewn under one modification in fig. 2, in which the float or hollow ball *w*, is attached to a rod *x*, the free end of which is

made to slide upon the lever *m*, and is secured thereto by a thumb-screw. By means of this arrangement the distance of the float from the valve may be varied, and the leverage thereby adjusted, to suit the pressure of the fluid on the valve.

Another modification of this part of the invention consists in making the float or ball *w*, to slide upon the lever which actuates the valve, and securing it thereto, at any desired part, by means of a pinching-screw or other suitable fastening.

The patentee claims, "First,—the general arrangement and construction of taps or valves suitable for the passage of water or other fluids, as hereinbefore described. Second,—the system or mode of arranging and constructing taps or valves wherein the fluid to be discharged passes first from the inlet branch of the shell into the body of the shifting-plug or valve-piece by lateral apertures therein, and thence escapes by similar apertures at another part of the plug or valve's length into the opposite discharge branch of the shell, as hereinbefore described with reference to fig. 1. Third,—the system or mode of arranging and constructing taps or valves wherein the fluid to be discharged enters the plug or valve-piece by lateral apertures, and is discharged down the centre of the plug or valve-piece, as described with reference to figs. 2, 3, and 4. Fourth,—the system or mode of adjusting or regulating the ball-float action of taps or valves by adding to or diminishing the effective leverage, as hereinbefore described with reference to fig. 2."

To GEORGE NEALL, *of Northampton, for an improved union gas-stove for lighting and heating.*—Dated 27th September, 1856.]

THIS invention has a twofold object, namely, that of combining what may be strictly designated a gas stove with that of a gas lamp,—thus effecting the double purpose of lighting and heating by one and the same apparatus; and which apparatus is so constructed as entirely to prevent or consume the nauseous vapour that is thrown off by the ordinary description of gas stoves while in use.

In Plate IV., fig. 1, represents a union stove and lamp as resting on a pedestal, suitable for lighting and heating vestibules, lobbies, or other such like situations. The gas is supposed to be carried up through the centre of the pedestal *a*, and through the base or stand of the stove *b*, and through the radial arms, partly shewn in dotted lines *d, e, f*; and to these arms (which may be of any convenient number) the circular rim *g, g*, is attached, around the outside of which a slight fence or rim is formed, which may be pierced or raised in any ornamental pattern or suitable design, and within this rim or fence the glass dome *h*, rests. The burners *j, j*, are fixed perpendicularly to the radial arms, or they may be inclined inwardly, if desired. In some convenient place, at or near the stove, it is necessary to have a stop-cock for regulating the supply of gas; the necessity of this will be hereafter referred to. The shape of the dome may be varied, but the form herein exhibited is preferred; and must be made without any openings or apertures otherwise than at its base; and, as a rule, the dome should be ground or deadened on the outside, which will tend to soften the effect of the light, and at the same time allow of its being painted, stained, cut, or otherwise ornamented.

In lighting this union stove and lamp it is necessary, as a precaution, to turn on at first but a little gas (which may be regulated by means of the stop-cock above referred to), and to light all the jets as simultaneously as possible. The small quantity of gas at first lighted will have the effect of gradually and uniformly heating the dome, and that done, the gas may be further turned on or increased, as required. This heating of the dome is effected by the then rarified and heated state of the air within it, which has no way of escaping but by being forced down by the continuous supply that is constantly rushing in around the burners supporting the flames, and ascending to the centre of the dome, there distributing itself, and descending close to its interior surface, and escaping beneath the rim *g, g*; thus there is a continuous stream of heated air continually pouring out underneath the rim of the dome, and diffusing itself around the apartment; and at the same time that light is emitted through the dome, heat is also thrown off from the surface of the dome by radiation.

This union stove and lamp may be constructed with or without the reflector marked *k, k*; but when that is used, the light is thrown down and diffused around the floor of the apartment: and this reflector being roughened, ground, or deadened on its under side, may, like the dome, be painted, stained, cut, or otherwise ornamented.

The same description of gas stove and lamp may be applied to a bracket support, suitable for being placed around galleries or walls of churches, chapels, or such like buildings, where light and heat are required to be generally diffused. The gas in this instance is conducted through a tube constructed or applied to the bracket, and thence to the burners; and around the rim that supports the dome, glass drops or prisms are suspended, and merely introduced here by way of ornaments.

Fig. 2, represents a plan view of the rim, radial supports, and burners *j, j*; the concentric circle *k, k*, representing the glass dish or reflector.

The union stove and lamp may also be adapted so as to be suspended from the ceiling, and may or may not be fitted with a slide and compensating or balance weights.

The patentee remarks that he does not confine himself in all instances to the use of glass for the dome, as in some cases (where heat may be more desirable than light) the dome may be made much thicker than the one here shewn, and formed of china or other suitable semi-transparent plastic material, and moulded in any suitable design on its exterior,—the parts fitted to it being of corresponding strength and character to match.

The patentee claims, "the use of a transparent or semi-transparent entire dome, with its attending parts, for the purpose of economising gas, by its diffusing light and heat at the same time."

To Frederick Ransome, *of Ipswich, for improvements in the manufacture of artificial stone, and in rendering it and other building materials less liable to decay.*—[Dated 27th September, 1856.]

This invention is applicable, first, to those descriptions of artificial stone which are compounded with sand, clay, and other mineral or earthy substances, together with soluble silica or a soluble silicate; and consists in adding thereto a substance which will fuse more readily than the sand,

and will run into and fill the pores of the stone, and thus increase its density. The substances preferred for this purpose are pumice-stone, or a readily fusible glass. When pumice-stone is employed, it is prepared in the following manner:—Take finely-powdered pumice-stone and mix it with a solution of soluble silica, sp. gr. (1·700), so as to form a stiff paste capable of being moulded, and mould it into balls of about one inch diameter, and fuse it in an ordinary crucible. When fused, grind it into a powder and mix with it a solution of silica, so as again to form a paste. In preparing the artificial stone the ingredients are mixed in the following proportions, by measure:—Siliceous sand 30 parts; finely-powdered silica 10 parts; solution of silica, or what is called silicious cement, described in the specification of a patent granted to the present patentee, 22nd October, 1844,* 5 parts, sp. gr. 1·700; powdered pipe-clay 5 parts; and pumice-stone, prepared in the way above described, 5 to 10 parts. These materials are mixed together and treated in the way described in the specification above referred to, and which is now well understood. When a readily fusible glass is employed in the manufacture of artificial stone, the glass is prepared by fusing together, in a reverberatory furnace or crucible, the following materials:—Silicate of soda 100 parts, sp. gr. 1·400; oxide of lead 100 parts. And in preparing artificial stone, for the 5 to 10 parts of the prepared fusible glass, is substituted 5 to 10 parts of the pumice-stone in the mixture before mentioned.

The invention also consists in a method of rendering artificial or natural stone, bricks, and other materials used for building purposes, less liable to decay. For this purpose the stone or other material is coated or saturated wholly or superficially with a solution of soluble silicate, and has afterwards applied to it a solution of chloride of calcium, by which an insoluble silicate of lime is formed in the body of the stone or other material. In place of a soluble silicate and chloride of calcium other preparations may be used; the invention consisting in the application, in succession, of two solutions, which, by mutual decomposition, produce an insoluble substance, which is deposited in the structure, and on to the surface of the stone or other material. When a soluble silicate is employed, the patentee takes a solution of silicate of soda or potash (the sp. gr. of which must depend upon the texture of the stone to be operated upon, but generally about the sp. gr. of 1·400 at ordinary temperatures), and after having removed from the stone, &c., as much extraneous matter as is convenient, the solution is applied over the surface of the stone or other material, with a brush or otherwise, until it has absorbed a sufficiency. A solution of chloride of calcium is immediately, or as soon after as convenient, applied—taking care to incorporate the two solutions as much as possible by means of a brush or otherwise. By this application the silica combines with the lime, forming silicate of lime in the pores and on the surface of the stone or other material, whilst the chlorine, combining with the soda or potash, forming chloride of sodium or potassium, is readily removed by washing. When the stone or other material is of a very porous nature, the strength of the silicate solution may be increased, and one coating will be sufficient; but if, on the other hand, the stone or other material is very slightly porous, then the strength of the silicate solution should be reduced, and several coats should be laid on. Or, for

* See Vol. XXVI., Conjoined Series, p. 307.

some descriptions of stone, more particularly sandstones or freestones, a saturated solution of sulphate of alumina instead of the silicate of soda or potash is preferred, followed by a solution of baryta; by which means a compound precipitate of alumina and baryta is produced. Where convenient, instead of applying the solutions by means of a brush, the stone or other material may be immersed in the several solutions. When desired, the precipitates can be colored to any tint to suit the stone or other material, by means of soluble salts of chrome or iron mixed with the solutions employed.

The patentee remarks, in reference to this part of the invention, that he is aware that wood has before been treated by two solutions mutually decomposing each other; he does not, therefore, claim the process as applied to wood, but only as applied to artificial and natural stones, bricks, and other materials used for building purposes. In some descriptions of stone and other building materials there is contained a free sulphate or carbonate of soda or other soluble salt which is liable to effloresce: to prevent this, and partially to indurate the stone or other substance, a solution of barium or calcium is employed,—a concentrated solution of the chloride of barium or calcium, by preference, being used.

To JOSEPH BUNNETT, *of Deptford, for improvements in the manufacture of metal sash-bars, columns, and mouldings for building and decorative purposes, and for a method of protecting the same or other articles from oxidation.*—[Dated 7th October, 1856.]

THIS invention consists, firstly, in the manufacture of sash-bars, columns, and mouldings of sheet-iron, by drawing the iron between suitable fixed or revolving dies; and such sash-bars may be formed with the tongue, or rebates complete from a single strip of iron, or from two or more strips combined; or the sheet-iron sash-bar may be drawn with or attached to a solid wrought-iron tongue, or with a wood or other suitable core. Secondly, in covering sheet-iron sash-bars, columns, and mouldings (made as hereinbefore described) by the ordinary modes of japanning and polishing, or with glass and vitreous enamels, and producing on the same and on sash-bars, columns, and mouldings of zinc, brass, or other suitable metals, ornamental designs in imitation of woods, marbles, buhl, or inlaid work, and other artistic devices. Thirdly, in coating sash-bars, columns, mouldings, shutters, and other articles of iron or other oxidizable metal with a protecting surface, by dipping them in or by brushing them over while in a clean and heated state with a thin solution of asphaltum in spirits of tar or other suitable solvent, and afterwards hardening the same by exposure to strong heat; this process being repeated until a coating of the required thickness is obtained.

For the production of sash-bars, columns, or mouldings, the patentee takes strips of sheet-iron, about $\frac{1}{20}$th of an inch in thickness, and of the proper width, according to the size of the finished article, and draws them through a series of suitable dies until the desired pattern is obtained, as is well understood by workmen accustomed to drawing metals. If the best charcoal iron is employed, and the pattern is not very intricate, it will seldom be necessary to anneal the iron between the drawings; but if, from the quality of the iron or the character of the pattern to be produced, the

metal does not work kindly, it is then annealed to facilitate and perfect the operation.

In Plate IV., fig. 1, is a section of an iron sash-bar with rebates complete, produced by drawing a single strip of sheet-iron through suitable dies.

Fig. 2, is a section of a sash-bar formed of two strips of iron *a*, and *b*, which are brought nearly to the required form by drawing them separately through suitable dies; they are then brought together and drawn through a finishing die, which unites them together and forms the complete bar.

Fig. 3, is a section of a sash-bar having an internal core of wood and an iron tongue. In this case the iron tongue *e*, is first enclosed in the sheet-iron casing *f*. The covering-piece *g*, being drawn of the shape required, the wooden core *h*, is placed therein, and the whole drawn through a finishing die, by which the ends of the covering-piece *g*, are brought under, so as to enclose the ends of the casing *f*, which unites all the parts strongly together.

Fig. 4, is a section of a sash-bar, produced by drawing a covering-piece of thin sheet-iron *c*, upon a cast or wrought-iron strengthening core *d*, of a cruciform shape,—the projecting limb of the cross forming the rebates.

Fig. 5, is a section of a sash-bar formed of one piece of sheet-iron, and an iron core of a T shape, the upper angles of the core fitting into the internal angles of the sheet-iron; and by being drawn through a finishing die, the edges of the sheet-iron are turned in under the T-shaped core and form the rebate.

Fig. 6, is a section of a sash-bar or column formed of one piece of sheet-iron, and a wood core of a suitable shape. The sheet-iron is first drawn to the proper size and shape, the wood core is then placed therein, and the whole drawn through a finishing die, by which the edges of the sheet-iron are turned over and driven firmly into the wood core. In the same manner columns or mouldings of any desired pattern may be formed of sheet-iron, and strengthened internally with cores of wood or iron, or of both combined, according to the purposes for which they are intended to be used.

After the sash-bars, columns, or mouldings of sheet-iron are thus produced, by drawing them through suitable dies, they are finished ready for use by coating them by the ordinary modes of japanning and polishing, or with glass or vitreous enamels (but in the latter case wooden cores must not be used). On such sash-bars, columns, or mouldings of iron, or of zinc, brass, or other sheet metal, ornamental designs may be produced in imitation of woods, marbles, buhl, or inlaid work, and other artistic devices. If the articles are of iron, however, it is preferred to coat them, in the first instance, with the protecting composition hereinafter described, and then ornament them by graining, coloring, gilding, or silvering, according to the style of decoration required.

The improved method of protecting sash-bars, columns, mouldings, shutters, and other articles of iron from oxidation, consists in coating them with a hard and impermeable surface, in the following manner:—The shutter-laths, sash-bars, or other articles of iron, are first cleansed and freed from scales, grease, and all other impurities, by immersion in a warm acid bath, composed of about one hundred parts of sulphuric acid and sixteen hundred parts of water, heated to about 130° Fahr. The articles are then rinsed in fair water, immersed in a solution of lime, and dried off

quickly in hot sawdust or in a heated chamber; they are then in readiness for dipping into the protecting composition, which is made as follows:—About six hundred parts of asphaltum are boiled in nine hundred parts of linseed oil: when the asphaltum is dissolved, two hundred parts of gum animi (or gum copal) are added, and to facilitate the admixture of these ingredients, one hundred parts of red lead and fifty parts of litharge are thrown in. When these ingredients are thoroughly incorporated, a sufficient quantity of spirits, obtained by the distillation of Archangel tar, is added, to bring it to a proper state of fluidity. The articles to be coated having been wiped clean, and heated to about 250° or 300° Fahr., are immersed in the composition prepared as above directed. After standing a short time to drain off the superfluous fluid, the articles are put into a stove or oven, heated to about 180°, and kept there until the protecting surface is thoroughly hardened. One coating will, in most cases, be found sufficient; but if a stronger protection is required, the process of dipping, drying, and hardening may be repeated. The protecting surface thus given is of a dark color: if other colors are required, a second or third coating may be given, in which any of the ordinary pigments may be introduced; but if light colors are used, gum copal must be substituted for the asphaltum. The protecting surface thus given forms an excellent ground for japanning, gilding, or such other artistic decoration as taste may dictate.

The patentee claims, "Firstly,—the manufacture of sash-bars, columns, and mouldings of sheet-iron, by drawing strips of that metal through suitable dies, as hereinbefore described. Secondly,—the ornamenting of iron sash-bars, columns, and mouldings by japanning and polishing, or by coating them with glass or vitreous enamels, and producing on the same, and on sash-bars, columns, and mouldings of zinc, brass, or other suitable sheet metal, various artistic designs. Thirdly,—the coating sash-bars, shutter-laths, columns, mouldings, and other articles of iron or other oxidizable metal with a protecting composition, as hereinbefore described."

To THOMAS DUGDALE, Jun., *of Blackburn, Lancashire, for an improved lubricator.*—[Dated 8th October, 1856.]

THIS invention consists in employing a vessel of any convenient size or material and shape, in the inside of which is placed a tube with a trough or mouth at the top of it, the said tube passing through the vessel to the shaft to be oiled or lubricated. A shaft is passed horizontally through the vessel, with a wharve or pulley outside, by which the shaft may be turned by any suitable means. This shaft, or another shaft driven by a pinion and wheel, or worm and wheel, from the first-mentioned shaft, is furnished with a groove or flanges, between which is placed a ring or endless chain, which revolves with the shaft, the lower part of the ring or endless chain being in contact with the oil or lubricating matter: the trough is placed directly under the groove or flanges, and does not touch the ring: the oil accumulates at the bottom of the groove or flanges until sufficient to make a drop, which enters the trough and passes through the interior of the tube to the shaft to be oiled or lubricated; or the trough or mouth may be so placed, that as the ring or endless chain revolves, it scrapes against the edge of the trough or mouth, thus allowing a sufficient

quantity of the oil or lubricating matter to pass down the tube to the shafting or other substance to be lubricated. By employing rings or endless chains of different thicknesses, a greater or less supply of oil can be given without changing the speed of the ring or endless chain, or taking off the lubricator. One or more rings or endless chains are employed, according to the size of the lubricator and the surface of the shafting or other substance to be oiled, near which the lubricators are fixed in any convenient position.

In Plate IV., fig. 1, is an elevation of a lubricator adapted for slow speeds, part of the vessel being removed in order to represent the interior. Figs. 2, and 3, are elevations of a lubricator adapted for higher speeds, also having part of the vessel removed.

In fig. 1, *a*, represents the vessel, through the lower part of which is passed the tube *b*, which is fixed to the bearing of the shaft or other substance to be lubricated: at the upper part of the tube is the trough or mouth *c*. Through the vessel is placed the horizontal shaft *d*, driven by the pulley *e*. Upon the shaft *d*, are the flanges *f*; between which revolves the ring *g*, its lower part being in the oil or lubricating matter *h*. As the ring revolves it carries oil along with it, which accumulates in the flanges until sufficient for a drop, which falls into the trough or mouth, and passes through the interior of the tube to the shaft or substance to be lubricated.

In figs. 2, and 3, the vessel is shewn at *k*, through which passes the horizontal shaft *l*, furnished with the pinion *m*, working into the toothed wheel *n*, upon the shaft *o*; causing it to revolve. Also upon the shaft *o*, are the flanges *p*, between which is the ring *q*; its lower part being immersed in the oil or lubricating matter *r*, and its upper part pressing or scraping against the mouth *s*, of the tube *t*. As the shaft *o*, revolves, the ring *q*, moves with it, carrying oil or lubricating matter, which enters the mouth *s*, of the tube *t*, and passes through the interior *u*, to the shaft to be lubricated. It will be understood that either the dropping or scraping arrangement may be placed in the vessel, whatever be the speed of the ring or rings, or endless chain or chains.

The patentee claims, "the arrangement and construction of apparatus for lubricating shafting or other similar materials, as herein described and illustrated."

To Frederic Albert Gatty, *of Accrington, Lancashire, for certain improvements in dyeing.*—[Dated 10th October, 1856.]

This invention consists in the use of nitrate of soda, sulphate of soda, chloride of sodium, sulphate of magnesia, sulphate of lime, and chloride of calcium in dyeing cotton with logwood, quercitron bark, Sapan wood, peach wood, Lima wood, and other dye woods of the same description.

In carrying out this invention, it is found that one pound of either of the above-named salts, or a mixture of two or more of them, placed in the vat with fifteen pounds of any of the above-named dye materials, produces a good result; the quantity of the salts may, however, be varied, as an excess produces no bad effect. Instead of mixing the said salts with the dye materials in the vat, as described above, they may be previously mixed

with the dye materials. The process of dyeing is carried on in the ordinary manner.

The patentee claims "the use of the above-named salts, either separately, or a mixture of two or more of them, in dyeing with the dye materials named above."

To PETER GASKELL, *of Kingston-upon-Hull, for the admission of steam into the cylinders of steam-engines by an equilibrium valve.*—[Dated 10th November, 1856.]

THE equilibrium valve, which forms the subject of the present invention, is composed of two plates of bell or other suitable metal, made either to revolve on a metal shaft in the case of a rotary valve, or to slide in the case of a sliding valve (as may be required), at a distance of about two or three inches apart from each other, within a metal valve-box of a circular or square form, as may be required. In Plate IV., fig. 1, is shewn a section of the improvement as applied to a slide-valve, and fig. 2, a section of the improved rotary valve. The valve-plates and box are all ground smooth and fitted so as to be perfectly steam-tight, except at the apertures in the lower plate, hereinafter mentioned. The steam intended to pass into the cylinder is first admitted into the valve-box in the intermediate space between such two plates. The pressure of the steam in the valve-box on the upper or outer plate thus counterbalances (or nearly so) its pressure in a contrary direction on the lower or inner plate, and produces an equilibrium; thereby obviating in a great degree the friction of the valve as it revolves or slides (as the case may be). The upper or outer of such two plates is without any hole or aperture for the passage of steam. The lower or inner of the two plates is perforated with holes or apertures proper for the passage of the steam from the valve-box into the cylinders, as the valve revolves or slides.

The diameter or the area of the surface of the upper or outer plate is somewhat less than that of the lower or inner plate, and thus the pressure of the steam, though very nearly at an equilibrium, is somewhat greater on the latter plate on account of its greater surface than the other,—and by this means the moving part of the valve is maintained in its proper place with sufficient tightness to secure its efficient working, but nevertheless without any such pressure on its seat as to cause disadvantageous friction.

To WILLIAM HENRY BALMAIN, *and* THOMAS COLBY, *both of St. Helen's, Lancashire, for improved means of grinding various substances.*—[Dated 12th November, 1856.]

THIS invention relates to an improved means of grinding various substances which may, with advantage and without detriment, be submitted to the operation hereinafter described. The invention consists in grinding, pulverizing, or levigating the substances, by agitating them in a liquid, together with a quantity of loose pebbles or small pieces of other hard substance.

The plan preferred for carrying out this invention is to place the substance to be ground, together with the pebbles or hard substances, in a cylinder made of iron, wood, or other suitable material. This cylinder is

supplied with a convenient quantity of water, oil, or other suitable liquid, and is mounted in bearings, in which it is made to rotate slowly by means of any suitable and convenient arrangement of machinery, which will readily suggest itself to any intelligent mechanic.

Instead of causing the vessel containing the pebbles, water, and substances to be ground to rotate as aforesaid, the pebbles or other hard substances may be agitated in the water or oil, together with the substance to be operated upon, by means of a screw, or paddles, or other agitating or stirring apparatus, which may be actuated by any suitable mechanism. This mode of operating may, perhaps, be found the best plan when working on very large quantities of material; but whatever mechanical arrangements are employed, it is proposed to use a number of unattached pebbles, or other convenient hard substance, as a means, by their motion in a liquid, of grinding or triturating the substance that is to be operated upon.

When the grinding operation is complete, the substance ground is separated from the pebbles by simply running it off in suspension in the water or oil. The separation of the ground or pulverized materials from the pebbles or triturating substance may be more effectually done by adding more water or oil to the mass in the cylinder after the grinding operation has been completed; but, during the process of grinding, it is found best to use only a small quantity of liquid in the grinding vessel. The substance ground may also be removed continuously, by letting a stream of water or liquid flow over the pebbles. When the substance is in lumps, and of a sufficiently hard nature, the pebbles may, to a certain extent, be dispensed with, by simply placing lumps of the hard substance itself in the revolving cylinder or grinding vessel. These lumps may be of any shape to commence with, as the pieces will, in time, work into the form of pebbles. In this case the lumps of the substance will have to be renewed from time to time, as they will grind themselves down; but when siliceous pebbles are used to grind a softer material, they do not require renewing. The size of pebbles found to work best is a variety from that of a pea to that of a walnut.

The patentees claim, "the grinding or triturating the substance to be operated upon in any suitable liquid, in such a manner that such substance may be reduced by the friction or rubbing of the lumps of the material against each other, assisted by pebbles or other hard substances, when required."

To JOHN FOWLER, jun., *of Havering, Essex, for an improvement in the manufacture of wire ropes.*—[Dated 2nd December, 1856.]

IN the manufacture of wire ropes, instead of having all the wires which are around the central core of one size or diameter as heretofore, and in place of all the wires being of iron, one of the wires in each strand is of larger size or diameter than the others, and this larger wire in each strand is made of steel: hence each strand of wire will have a spiral ridge around it, and when such strands are laid together, the projecting ridges of the strands which are outwards rest on or against any surface on which the rope is moved, and the steel projecting wires are the ones which are first worn away.

The patentee says,—" I have found that about three sizes larger is a convenient size for the larger wires, though I do not confine myself thereto,

as the size may be varied; and I make such larger wires by preference of steel, in order that they may wear better and longer, and preserve the others from wear."

To ROBERT DRYDEN, *of Kinaston-street, Lambeth, and* STEPHEN MILES, *of Willow-walk, Bermondsey, for an improvement in the construction of cylinder printing presses.*—[Dated 2nd December, 1856.]

THIS invention relates to the application to that class of printing presses known as cylinder perfecting machines (in which the paper is fed into the machine by tapes) of an additional feeder, for placing under the sheet to be printed, as it comes on to the second cylinder, a second sheet, which shall take the "set-off" from the printed sheet, and thus ensure cleaner impressions than have hitherto been obtained in such machines.

To attain this end a set of tapes is applied to the printing machine, so arranged that they will carry forward from the feeding end of the machine the sheets intended to receive the set-off; passing them under the first cylinder and presenting them to the second at the moment that the sheet which has received the impression of the first form is being laid upon the second cylinder, to receive the impression of the second form.

In Plate IV., fig. 1, shews, in side elevation, so much of a cylinder printing machine, with the invention applied thereto, as will serve to explain the mode of carrying out this improvement; and fig. 2, is a diagram shewing merely the arrangement of the tapes for effecting the additional feed. Dotted lines in fig. 1, shew the course of the ordinary double set of tapes for passing the paper to be printed over the two forms, and dotted lines of another character in both the figures 1, and 2, shew the course of the tapes for conducting the set-off sheets from the feeding end of the machine to the second impression cylinder, where they receive the set-off from the printed side of the paper under the process of printing, and thus prevent the accumulation of ink upon the surface of that cylinder. *a*, is the first, and *b*, the second impression cylinder; and *c*, and *d*, are the drums for guiding the ordinary tapes from one cylinder to the other. On reference to fig. 1, it will be seen, that in order to permit of the introduction of the extra feed, the ordinary return tapes are opened back, and set-off sheet tapes are inserted between them. These tapes are passed over rollers in the usual way,—the rollers which carry the ordinary tapes being made use of wherever practicable; and where these are not applicable or sufficient other rollers are introduced, as at *e*, *e*, *e*. The set-off sheets are laid on a feed-board *f*, *f*, and are pushed forward by hand until they are seized in succession by the dropping bar *g*, which is operated (as is common to such mechanism) by crank arms and a connecting-rod, actuated by a cam on the axle of the cylinder *a*: the sheets are then drawn between the double set of travelling tapes. As the sheet of paper to be printed passes round the impression cylinder *a*, the set-off sheet follows it, but the paper, after passing over the first form, is carried up by the cylinder *a*, and delivered by the tapes to the drum *d*, whence it travels to the drum *c*, to be passed to the second impression cylinder *b*. The set-off sheet, however, when leaving the cylinder *a*, is carried by its tapes past the drum *d*, and under the drum *c*, where it meets with the printed sheet, which has arrived at this point by a longer route, and it then passes with it (in contact with the printed surface) on to the impression cylinder *b*. The two sheets are

now carried round and brought over the second form—the set-off sheet being between the sheet to be printed and the cylinder: the set-off, therefore, caused by the pressure put upon the under sheet to produce the required impression, instead of being received on to the blanket covering the cylinder (which set-off would soil the next succeeding sheet) will be received by the set-off sheet carried by the extra feed; and thus the succeeding sheet of printed paper will be delivered in a clear state from the machine. The printed sheet leaves the tapes at *h*, (fig. 1,) and is there received on to the board *i*, in the ordinary way; but the set-off sheet passes upwards, and is delivered on to a board at *k*.

From the above explanation it will be understood that the speed of printing in perfecting machines, fitted with these improvements, will be in no way interfered with, and that the main change in the old mechanism will be the re-arrangement of the tape rollers, for the purpose, firstly, of opening out the return tape, to permit of the insertion of the set-off feed-board tapes and rollers between it and the ordinary feed-board; and, secondly, that the return part of the tape between the two impression cylinders may be thrown down, to make room for the delivery board of the set-off sheets.

The patentees' claim is, "arranging the tapes as herein described, whereby we are enabled to introduce the set-off sheets at the feeding end of the machine."

To FREDERICK ALBERT GATTY, *of Accrington, Lancashire, for improvements in the construction of filters or drainers.*—[Dated 3rd December, 1856.]

THESE improved filters or drainers are made by preference of wood and of a square shape, but they may be of other shapes, and other materials may be used. The sides and bottom of the filter or drainer are furnished with narrow slots made with a circular saw or otherwise. When the filters or drainers are made of wood it is requisite to make the slots in a line with the grain of the wood. They may be rendered suitable for filtering different materials by increasing or diminishing the width of the slots, according to the fineness or coarseness of the substances to be separated from the liquids. In some cases the slots of these filters or drainers may be filled with animal charcoal or other purifying material. These improved filters are said to possess considerable advantages over those in general use, which are usually made of woollen or other fabric, and are soon injured by being continually wet, and by the action of acids. The improved filter, after being in operation, is easily cleaned by passing a suitable instrument through the slots, to free them from any substances adhering thereto.

The patentee claims "the improved mode of constructing filters or drainers as described."

To JAMES BLAIN, *of Belfast, for improvements in Jacquard apparatus for weaving.*—[Dated 8th December, 1856.]

THIS invention relates to what are technically known as the "cards" or perforated pieces or surfaces employed in weaving ornamental fabrics in the jacquard loom, and consists in making the cards or pattern surfaces of such materials, and in such manner as to secure them from derangement

from thermal changes, which ordinarily result in seriously objectionable expansion and contraction. These new cards or pattern surface pieces are made of woven fabrics, such as linen or cotton cloth, joined by adhesive matter to any other suitable substance, such as paper; and when a pattern is worked out, the old cards may be rendered fit for carrying new patterns by having an unperforated layer pasted down upon the face, when the perforations for the new pattern may be made as in a fresh unused card.

The cards used in weaving by jacquard machinery have hitherto been made of pasteboard, cut to an uniform size, and pierced with holes by means of punches or a cutting machine, in accordance with the design it is desired to produce in the loom. But when thus produced, they are subject, as above stated, to expansion and contraction, which deranging actions are attended with much inconvenience in the use of the cards. Moreover, from the nature of the material of which the cards are made, they are easily broken or torn, and are quickly rendered unserviceable, thereby entailing considerable expense in the replacing of them. The object of this invention is to obviate these evils, by making the cards of a combination of materials not liable to be affected by atmospheric changes, at the same time increasing their durability. The ordinary jacquard cards, after having been used for one particular pattern, are useless, and are then thrown aside as waste material; but the cards manufactured according to this invention may be used over and over again for the weaving of the same or different designs. This renewal of the cards, as it may be termed, is a point of great importance to the manufacturer, as a set of cards may be renewed at much less expense than a new set of the ordinary cards would cost. In manufacturing cards for weaving, according to this invention, suitable lengths of linen or cotton cloth are coated on one side with glue or other adhesive matter, upon which is laid one or more layers of paper or thin pasteboard. These combined materials are then submitted to pressure by passing them between rollers or through suitable pressing machinery. This operation forces out the superfluous glue or other adhesive matter, and presses the textile fabric and the paper closely together. The combined material is finally dried, and is then cut into pieces of an uniform size, corresponding to the cards ordinarily used. The improved cards thus prepared are perforated or cut in the ordinary manner, and are then ready for the use of the weaver. The cards made according to the foregoing system are thin and light, but exceedingly firm, and nothing short of extreme violence will injure them. The renewal of these improved cards, after the pattern is done with, is very readily effected. One side of the used card is covered with paper, which is attached to the card by means of glue or paste, and upon the paper is placed a layer of linen, cotton, or other textile fabric, cemented to the paper by glue or other adhesive material. The renewed cards are then rolled or pressed, and finally dried: they are then ready for being perforated or cut, in the same manner as is practised with new and unused cards. When the renewed cards are no longer required for the second pattern for which they have been perforated, they may be again renewed by covering them with paper and a textile fabric, as before explained, and this operation may be repeated several times before the cards become useless.

The patentee claims, "First,—the system or mode of combining textile fabrics with paper or other suitable material for the manufacture of cards

to be used in jacquard machinery, as hereinbefore described. Second,—the system or mode of manufacturing cards for jacquard weaving by the combination of a textile fabric with paper or other suitable material, as hereinbefore described. Third,—the system or mode of renewing jacquard cards that have been used in jacquard weaving, and rendering them again fit for use for other and different patterns, as hereinbefore described."

To WILLIAM SMITH, *of Salisbury-street, Adelphi, for certain improvements in the machinery for and method of making and laying down submarine and other telegraph cables; which machinery is also applicable and is claimed for the making of ropes and cables generally.*—[Dated 28th May, 1853.]

THIS invention consists in certain novel arrangements of machinery for making submarine and other telegraph cables, wire, and other ropes, lines, and cables, whereby they can be made more rapidly and perfectly than hitherto. This novel arrangement of machinery admits of being erected of a sufficient size and power on board a ship or other suitable vessel, to make submarine and other such cables on shipboard; thus the labor of shipping or transporting such cables will be greatly reduced, as when made they will be ready to be submerged or otherwise laid down, or, when desirable (as for very long and continuous lengths of trans-oceanic lines of electro-telegraphic connection and communication), the cable may be tested while in course of manufacture, and when so tested and found to be perfect, payed out and submerged at a speed proportionate to the speed of manufacture.

In Plate III., fig. 1, is a section of one of a series of bobbins or reels employed in the manufacture. These reels are mounted in fixed frames *a*, *a*, *a*, provided with grooved antifriction rollers *b*, *b*, *b*, arranged at proper distances apart. *c*, *c*, are bearing wheels, placed within the grooved antifriction rollers; and *c**, *c**, *c**, are toothed wheels (or strapped pulleys) securely connected together in pairs by the short studs *d*, *d*, *d*. The long stays *e*, *e*, *e*, (of which there may be four or more around the circumference of the ring of the bearing wheels and toothed wheels or band pulleys) are made to connect them together throughout the length of the series of machines, forming a skeleton drum the whole length thereof. One or more, if necessary, of these stays in each series is made so as to be easily moved, to allow of the bobbin or reel being taken out and removed when necessary: they are shewn as jointed at one end and fitted with a screw socket at the other; but any other suitable mode may be adopted.

The ring of each of the bearing wheels, and also of the toothed wheels or strap pulleys, are drilled with numerous concentric holes properly countersunk to admit of the several wires or strands passing through them on their way from their respective bobbins or reels to the front of the machine, where they are gathered up and united to form a cable, rope, or strand. Upon the face side of the boss of each of the bearing wheels *c*, *c*, *c*, and also of the toothed wheels or strap pulleys *c**, *c**, *c**, a projecting snug is cast to form a bearing for the axle or spindle of the bobbin or reel *f*, as shewn at *g*; a proper bearing being secured by a top brass fixed and regulated by a key wedge or screw: the wheels *c*, and *c**, are secured back to back by the short studs *d*, *d*. The bobbins or reels *f*, may be en-

tirely of plate iron, or iron flanches and wooden bodies secured upon an iron axle or shaft running through them, having a journal turned at each end of each, to fit properly in the bearings, as shewn at the centres of the wheels *c*, *c*, and *c**, *c**.

To the axle or flanch of these bobbins or reels is affixed a friction strap wheel, of gun metal or other suitable material: around these friction wheels a friction strap passes, and is secured by its ends to the arm of the wheels *c*, and *c**, so as to carry round the bobbins or reels *f*, in the same direction as the revolution of the wheels *c*, and *c**, and the skeleton drum which surrounds the bobbin or reel *f*; but the friction strap is so regulated, by means of a screw or other suitable adjustment, as to allow of the bobbins having an independent axial motion, that the wire or strand wound thereon may be easily drawn off as it is required in the process of manufacturing any cable, rope, or strand,—but at the same time avoiding any slack or irregularity of supply.

A guide-pulley *h*, for taking off the wire or strand from the bobbin or reel, and directing it to its proper hole in the series of wheels through which it has to pass, should be fixed to one of the stays or a bar for the purpose; this guide-pulley *h*, may be made to travel back and forward on the stay or bar by a screw and nut, or some equally suitable arrangement for that purpose; motion being given to it by a small ratchet-wheel or pinion fixed on the end of the screw; the motion being reversed by a second pinion in gear with the first being acted upon, instead of the one directly on the end of the screw. The ratchet-wheel coming in contact with a fixed stud or studs, is moved one tooth or more at a time as may be required.

Fig. 2, is a section of a reel or bobbin which contains the core or heart-wire; whilst the reel in fig. 1, contains the protective wires or other covering for submarine telegraph cables, or the wire strands or other materials, in the making of ropes, cables, or lines. The core machine is placed at some distance from the last of the smaller machines, but is connected therewith by strong stays, and revolves at the same velocity, although it may be driven either by its own gearing or otherwise.

Fig. 3, is a side view of the improved apparatus for forming the wires or strands into a rope, with the "taking-off rollers" connected therewith. From the front of the first bobbin or reel a number of strong stays *i*, *i*, project, and converge towards a point in front of the perforated cone, register, or laying-plate *k*, where the wires or strands unite: these stays are connected to the back of the cone or laying-plate *k*, which is supported in a bearing in the standard *l*.

Upon the collar of the cone or laying-plate is shewn a band-wheel or chain-pulley *m*, which may be used for giving motion to the "taking-off rollers."

The tube or nipper *n*, receives the united strands or covered cable, and corrects any irregularities therein. Upon suitable framings the taking-off rollers *o*, *o*, *o*, are fixed, with adjustments to regulate the amount of pressure to be given and power to be applied to drawing off at a proper velocity the strand, rope, or cable, when laid up. These rollers have a series of semicircular grooves of different sizes turned on their peripheries, and are made to slide upon their respective shafts or axles, so as to bring the groove or score of the size required for the cable, rope, or strand, then in course of manufacture, opposite to or in a line with the centre of the tube or nipper,—a groove and feather being fitted to each roller and its shaft for

this purpose. A rotary motion may be given to these rollers by means of a worm and worm-wheel or other direct gearing, which may be regulated by a set of change-wheels or cone-pulleys to proportion the speed of the drawing off, according to the "lay" intended to be given. To one or other of the shafts of these draw-off rollers a counting apparatus is attached for measuring the quantity made.

When drawn off, the cable, rope, strand, or line, may either pass over a bearing-pulley *p*, to be coiled down in any suitable place, or be coiled down at once.

A driving-shaft *q*, having upon it several spur-wheels to gear with and drive the toothed wheels *c**, *c**, *c**, of the machine, is properly hung in bearings or otherwise supported; or, instead of the spur-wheels, band-pulleys, should they be found desirable, may be substituted, and so drive by bands instead of gearing.

If the core-bobbin or reel, fig. 3, be filled with prepared insulated wire it is placed within the skeleton frame or drum; and the hollow shaft, having several insulated metal rings *r*, *r*, *r*, mounted on its extension, is put through it, and the inner end of the wires opened out and passed through the shaft, one to each ring, and to which they are connected respectively by a binding-screw.

In contact with each of these revolving rings, which are properly insulated from each other, a metallic spring *s*, is fixed, communicating with a bell or other signal apparatus, which is set in action by the breaking or injury of any of the insulated wires, while in course of being made up or manufactured into a telegraph cable, and before it leaves the machine.

The outer end of the coil of core wire is unwound from the bobbin or reel, and passed over the guide-pulley *h*, through a countersunk hole in the rim of a large wheel *c*, or *c**, through a similar hole opposite thereto in the rim of the wheel of the last bobbin, and in the same way through each series of wheels *c*, and *c**, until it reaches the centre tube or hole of the perforated cone register or laying-plate.

In the same manner the wire or strand from the last reel is passed over the guide-pulley, and through the proper holes in the wheels *c*, of the last reel-wheel *c**, of the next reel, and so on through the whole until it reaches the holes in the wheel *c**, of the first wheel: from thence it is passed through one of the twelve, or other number of concentric holes in the cone register or laying-plate, and in like manner each of the wires is brought forward.

When it is desired to use a core more rigid than heretofore applied, and to lay around it a coating of wire or other material or form of material, or to blend them together in any manner whatsoever, the axles or shafts of the bobbins or reels may be hollow, and the bosses of the wheels *c*, and *c**, bored out to allow of a through passage from end to end of the machine.

The next part of the invention relates to laying down or submerging trans-oceanic or submarine lines of telegraph communication. The machinery, as previously described, is particularly suited to this purpose, from its horizontal position and arrangement, and the absence of any great weight revolving at a distance from a centre, as in the case of the machines hitherto constructed for making ropes, cables, &c., where a similar number of bobbins or reels, containing varying and unequal weights of material, are arranged in a circle of necessarily large diameter, and revolve around a common centre. The velocity at which the whole mass of machi-

nery, as well as the materials, have to rotate, is of necessity very limited, disproportioned to the work done, and from their form of principle, unsuited for such an application as that which is now proposed.

The same arrangement of machinery as just described is placed upon suitable timbers laid as far aft as possible upon the keel or keelson of a suitable ship or other vessel, so that the dead weight will be directly in the centre line along the length of the keel and at the lowest point in the body of the vessel, and where the pitching and rolling of the vessel will least affect the working of the machinery or the workmen, and others engaged in attendance thereupon.

Motion may be communicated to the machinery by a steam-engine, through straps, bands, or gearing, and the cable, as made, may be carried through a hawse-hole, or brought on deck and lowered over-board, under control, by a suitable arrangement of brakes and drums, or coiled down between decks or upon deck ready for use, as may be, under varying circumstances, deemed advisable.

The stores of materials, prepared as far as possible, for use, may be stowed forward between decks and alongside the machine. Numerous extra bobbins or reels should be filled with the wire and other materials, and a suitable arrangement of winding machinery, driven by the engine fitted up on board, to re-fill several of the bobbins or reels at one time as the materials are being consumed in the machine.

A portable forge for welding or brazing the ends of the wires together, as well as all the usual tools and apparatus for conducting such a manufacture on land, must be provided.

The person in charge of the instruments, as before described, for testing and proving the perfect state of insulation of each of the metallic wires of communication, should have command over the working of the cable-making machinery, as well as the power to direct the stoppage of the forward motion of the ship; and by having the starting or clutch-lever of the machinery under hand, he will be enabled, in case of accident or whenever necessary, to stop its action instantaneously, without damage to any of its parts.

The patentee claims, "First,—the novel and peculiar arrangement of machinery, as above described, for making submarine and other telegraph cables (whatever the materials, or the form or arrangement of such materials used may be), and wire and other ropes, lines, and strands generally. Second,—the setting up of such machinery on board of steam or other vessels, whereby submarine and trans-oceanic telegraph cables may be manufactured and submerged simultaneously or otherwise."

To Anne Marie Macé, *Widow of Georges Fremont, of the Rue des Collonnes, Paris, for a new manure for preventing the vine and other diseases arising from the soil, and for other similar purposes.*—[Dated 9th December, 1856.]

This invention consists in employing the ashes of wood and charcoal, or coal cinders, or other similar ashes, combined with human urine, in equal proportions by measure. The mixture of the above-named substances constitutes what the patentee calls "Fremont's manure."

The use and purpose of such compost is similar to that of any other ar-

tificial manure. For vines, it is only requisite to apply to the foot of each stock a compound of about two pints of ashes and two pints of urine. For tilling land the quantity to be used may differ, according to the quality of the soil to be operated upon, but the mixture must be in the proportions, or about the proportions, before named. Such manure destroys a quantity of insects noxious to the products of the soil, and greatly improves the lands submitted to its action.

The patentee claims, "the use and application of the combined materials hereinbefore referred to for the purposes set forth."

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 42.)

The following paper by Mr. E. D. Chattaway, of Edinburgh, was next read:—"*Description of a central buffing and drawing apparatus for railway carriages.*"

The frequency of accidents arising from the insufficiency or defective nature of railway couplings, more especially those of the waggon stock, induced the writer to endeavour to discover some simple and inexpensive means of remedying so serious an evil; and he was led to the conclusion, that a new form of coupling, combined with a centre buffer, was the only effectual mode of accomplishing the desired end. He accordingly adopted an arrangement, the principle of which is a combination of the whole buffing, coupling, and drawing mechanism upon one central rod, thereby dispensing with the use of separate corner buffers and side chains.

The buffer and draw-hook are constructed in one piece, and the buffer head, instead of being circular, is curvilinear only at its lower portion, its upper part being made narrow. While presenting a buffing surface in front, it is shaped on its inner side similar to a draw-hook, for the purpose of receiving the coupling link, which works upon it as upon an ordinary draw-hook, and thus forms a complete hook and link connection. The draw-rod is screwed near the end just within the buffer head. Upon this screwed part is fitted the adjusting nut and collar, which is provided with projecting arms for carrying the large coupling link. The coupling can thus be drawn hard up or slackened off by means of a pendulous lever as occasion may require.

The advantages claimed for the central buffing and coupling appatus are the following:—

Firstly, economy of cost and simplicity of construction, the cost being less than two-thirds that of the corner buffer arrangement: the parts are few, easily fitted together, and not liable to get out of order.

Secondly, facility of coupling and uncoupling: it requires no sudden shunting of the train together to slip the coupling over the draw-hook, since the coupling link is attached to a collar moving freely round the draw-bar, and can thus be raised and attached even when the buffer-head is in contact with the draw-hook.

Thirdly, saving in dead weight: the new coupling is upwards of 5½ cwt. per waggon less than the average weight of the ordinary buffing and coupling apparatus; this in a train of 30 waggons gives a saving of dead weight equal to 8¼ tons. Taking the cost of hauling one ton at ·20*d*. per mile, the money saving averages 1·65*d*. per train mile; or assuming the average daily mileage of a train to be 120 miles, the daily saving is 16*s*. 6*d*. per train, equivalent to the wages of the engineman, fireman, and guard,

Fourthly, the reduction in wear and tear of waggons, by lessening the amount of shunting and the sudden jerking of the waggons. Also the buffers being in the centre of the waggon or carriage are always practically in the same straight line, and receive the whole force of the shock when the train collapses; thus relieving the train from the severe strain to which it is subjected when corner buffers are used.

Fifthly, the non-liability of this apparatus to break away or become uncoupled,—the parts being few, simple, and made of suitable strength, and the couplings being drawn tight up.

Sixthly, economy of motive power and cost of maintaining the permanent way. The centre buffers and couplings do not require so much space between each waggon as the ordinary buffers. They also save space by the couplings being screwed tight up,—the present waggon couplings having from six to 18 inches play. Taking the saving of space between each waggon at 14 inches, this will amount to a total saving in length of 35 feet in a train of 30 waggons. Farther, the buffing action being in one continuous line at the centre of the carriages or waggons, there is little tendency to any transverse action or pressing of the flanges of the wheels against the rails while passing round curves, as is the case with the corner buffing system, which causes a considerable loss of engine power, and acts injuriously upon the permanent way. The writer believes that the general experience of working railways corroborates the opinion that a long train takes more power per ton to drag it along than a short one.

The centre buffing and coupling apparatus has been applied to two of the mineral waggons running on the North British Railway, with a view of determining the practicability of using it conveniently in connection with the ordinary buffers and couplings. These waggons have been running for nearly five months upon one of the coal branches, having a gradient of 1 in 25 with curves of 300 feet radius, and the result has been to establish decisively the feasibility of the centre buffers working satisfactorily amongst stock with corner buffers.

The following paper, by Mr. Robert Harvey, of Glasgow, was next read:—"*Description of an improved sugar-evaporating apparatus.*"

In concentrating cane-juice, after it has been expressed by the cane-mill, a variety of processes have been adopted: the apparatus most generally in use is called the "battery," and consists of five or six pans all placed in a line, each less than the preceding one, in the proportion that the liquor is concentrated. The liquor is first put into the largest pan, and ladled from one to another successively till its arrival at the last, called the "finishing teache," in which the sugar is brought to the

required density. It is thence taken to the curing house, where it is placed in suitable vessels for allowing the complete drainage of all the molasses or uncrystallizable portion; a large part of which, however, can be rendered into sugar by re-boiling, which is mostly effected in refineries in this country. In this process, the greatest danger arises near the termination of the boiling in the teaches, under which the fire is immediately placed. The density to which the sugar has been brought renders carbonization difficult to be avoided at this stage of the process, and great care is necessary in the management of the fire.

To meet these difficulties, the improved apparatus, named after the inventor the "Bour" pan, was constructed, by which the requisite degree of concentration can be arrived at, without the possibility of applying a temperature injuriously high.

This pan is now successfully in operation in many of our sugar-growing colonies. It consists of a series of thin hollow discs of copper, securely fixed upon a central shaft which is revolved in bearings in a frame that also carries a shallow pan. The discs are heated and maintained at a uniform temperature by steam, which enters at one end of the hollow axle. A section of the axle is a cross, the edge of each portion having a flange set to one side, forming longitudinal grooves, the use of which is to retain the condensed water from the steam, and deliver it at the extreme end of the axle. The length of the axle is about nine feet, and it has fitted upon it ten hollow discs, measuring three feet in diameter. In the inside of each disc are two spoons, which run from the circumference to the centre, and terminate in tubes. Their use is to collect the water of condensation from the steam and deliver it into the longitudinal grooves in the axle. On the outside of the discs is a series of small buckets, which lift the liquor as the discs move round, and being open at the sides allow a quantity of it to be distributed in a thin equable film over the entire portion of the surface of each disc that is not immersed in the liquid. This is a feature in the machine that is peculiarly favorable to the liberation of water from the liquor undergoing concentration, when it approaches the density necessary for finish. The bottom of the shallow pan is curved to a radius about 1½ inch longer than that of the discs, and into it the cane-juice is run, after having been evaporated in open pans to 28° or 30° Baumé. When the concentration has been carried to the required degree, the remaining liquor is run out of the pan by a discharge-pipe.

The discs are made to revolve about ten times per minute. The exhaust steam from a high-pressure engine is made to enter at one end of the hollow axis at 2 lbs. per square inch pressure above the atmosphere, and the large amount of heating surface which the discs expose for the steam to act upon is the source of the efficiency of the apparatus as an evaporator. The low temperature under which the process is effected, the liquor never exceeding 170° Fahr., renders it peculiarly adapted for the colonies, where skilled labour is very expensive, and in many places cannot be had.

The adoption of the Bour pan supersedes the use of the teache in the battery, and the granulation of the sugar is finished at a much lower temperature than by the teache—thereby avoiding any tendency to carbonization of the sugar An apparatus designed for the same object had been previously introduced under the name of the "Wetzel" pan, so

called from its inventor. It consists of two hollow discs, mounted on a hollow axle, and further connected together by a number of horizontal tubes. Steam is admitted to one of the discs through the hollow axle, and passes through the tubes to the other disc, in which the water of condensation collects and is carried off through the axle at that end. In the use of the Wetzel pan it was found that the crystallization of the sugar is most perfect at the two end discs; and this circumstance led to the adoption in the Bour pan of a series of discs in the place of tubes, whereby the whole apparatus now produces the superior crystals that were previously obtained only from the two end discs.

A trial made recently with one of the Bour-pans, on the premises of the manufacturers, Messrs. D. Cook & Co., of Glasgow, proved highly satisfactory: the pan was used to concentrate a hogshead of molasses, weighing about 9 cwt., which was boiled to the proper density in twenty minutes. This experiment was made in the presence of several planters and other gentlemen interested in the colonies, and appeared to afford full satisfaction: the sugar produced was considered by refiners equal to that produced in the vacuum pan from the same materials.

Mr. James Johnstone said the rapid evaporation of the syrup at a low temperature was a point of great importance in the manufacture of sugar, and he had spent much time and money on that subject.

The principle of surface evaporation, on which the apparatus described in the paper acted, was, he believed, first introduced in the construction of evaporating apparatus, by Mr. Cleland, of Glasgow, who employed a pipe coiled in the form of a helix rotating on a horizontal shaft, steam being passed through the coil, the lower side of which was immersed in the liquor to be evaporated. An improvement on this apparatus was made by Mr. John Aitchison, of Glasgow, consisting of a copper cylinder or drum filled with steam; and this apparatus was much used in that neighbourhood, especially for concentrating bark liquor for tanners.

The apparatus that he had himself tried for surface evaporation was formed of an inclined plane or table of cast-iron 22 feet long, made in two thicknesses, steam being admitted between the plates so as to keep the table at a uniform heat: the surface of the table was polished, and one end of it raised a little higher than the other; so that when the liquor to be evaporated was allowed to run on at the upper end, it spread itself over the table and ran down to the lower end, where it was received into the sugar moulds in a state fit for crystallization. One circumstance incidental to this mode of evaporation, which he thought deserved particular attention, was the peculiar power that the air possessed of clarifying sugar: this was a fact of much importance to sugar-growing colonists, and he believed it to be a novelty in sugar refining: he had made the discovery of the circumstance some years ago, but had not previously made known the particulars of it. In the evaporation of sugar on the inclined plane, it was observed that when the thin film of syrup was passing down the table, the boiling action produced by the heated plate caused all the foreign particles of dirt and coloring matter in the liquor to rise to the surface, where the air immediately seized upon them and formed them into a scum, which floated along the surface of the liquor and could not sink. When the sugar had crystallized

and cooled in the moulds, all the scum was found on the top in the form of a cake or layer, one or two inches thick, which was easily taken off, leaving the sugar below in a purified state. He thought some advantage might be gained, where the Bour pan was used, from this action of the air in clarifying the sugar, if proper attention were paid to the subject.

There was, however, at present, unfortunately, a serious obstacle to the introduction of any such improved apparatus into the colonies, from the objectionable state of the custom laws. All sugar imported into this country was charged with a high rate of duty, if equal to what was technically called "clayed" sugar, that is, sugar that has undergone a process of claying or refining after being boiled. If, therefore, the planters in the colonies were to adopt the plan he had described, whereby the sugar was made in the raw state equal to that which had undergone the subsequent process of claying, they would not reap any benefit from the improvement, because the high duty payable on clayed sugar would be charged. This was a subject that affected not only the colonists, but also all the consumers of sugar in this country: for if, by the simple process of boiling the cane-juice, the sugar planter could produce raw sugar of such a quality that it could be used at once without having to pass through the hands of the refiner in this country, the price would be reduced.

Mr. Harvey said the remarks that had been made on the very injurious effect of the present custom laws were certainly too true: he had found, as a manufacturer of sugar machinery, that the planters had no inducement to avail themselves of improvements such as had been suggested, as the result would be that they were exposed to a heavier duty, absorbing the advantages they might derive.

The following paper, by Mr. JAMES P. JOULE, of Manchester, was next read:—"*On a surface condenser.*"

The principle of surface condensation, as applied to steam-engines, was, as is well known, introduced by Watt, who, in his first experiments, employed pipes immersed in cold water as the means of condensing the steam and producing a vacuum. It was, however, speedily abandoned by this great man, who substituted for it the injection in a separate vessel, as employed almost universally at the present time. Surface condensation has, however, since the period of Watt, been repeatedly attempted with more or less success by various individuals, among whom may be specially mentioned Cartwright, and Hall, the former of whom designed an engine which has been too little studied, though of admirable simplicity, and combining all the essential apparatus of a perfect surface condenser; and the latter, by his long continued and laborious efforts, nobly strove to introduce what he justly considered a great improvement. Without going farther into the claims of the many able men who have laboured unsuccessfully in this direction, it may be remarked, generally, that the system has not been so much in fault, as the imperfect means employed to carry it out.

Having been for a long time impressed with this idea, the author had great satisfaction in embracing the opportunity for experiment which unexpectedly presented itself on the occasion of the erection of a small

high-pressure engine, for the joint investigation of Professor Thomson and himself on the thermal effects of fluids in motion.

This engine has a cylinder of 6 inches diameter, and 6 inches length of stroke; it makes 180 revolutions per minute when going at full speed. Being fitted with the ordinary three-ported valve, the steam is cut off only after the piston has accomplished two-thirds of its stroke. The force-pump for feeding the boiler is single-acting; the ram is $1\frac{1}{2}$ inch diameter with $1\frac{3}{4}$ inch length of stroke, and is worked from an excentric on a shaft, which makes 1 revolution for every $3\frac{1}{2}$ revolutions of the engine. The volume of steam passing through the cylinder, compared with the volume of water propelled by the force-pump, is therefore in the ratio of $6^2 \times 6 \times \frac{2}{3} \times 2 \times 3\frac{1}{2}$ to $(1\frac{1}{2})^2 \times 1\frac{3}{4}$, or as 256 to 1. When the steam is at a pressure of 15 lbs. above the atmosphere, rather less than one-third of the capacity of the pump is required in order to keep the boiler full; leaving the remaining two-thirds available for the purposes of an air-pump.

Although it seemed at first sight impracticable to work the engine with an air-pump of so small a size, it was resolved to make a trial of it, and accordingly the eduction-pipe was connected with the end of one of the legs of an iron tube, $1\frac{1}{2}$ inch diameter, bent into the form of a syphon of 10 feet height; the end of the other leg being connected by means of a smaller pipe with the feed-pump. By this means the steam, after passing through the cylinder, is made to ascend one leg of the syphon to the height of ten feet, and afterwards to descend through the iron pipe, forming the other leg, which is 10 feet long and $1\frac{1}{2}$ inch diameter. The descending pipe is surrounded with a current of water ascending upwards in an outer concentric pipe of 4 inches diameter, by means of a pump. The condensed water, along with the air which enters by leakage, is cleared out by the feed or air-pump; the water being forced into the boiler through a feed-pipe, while the air is allowed to escape from an orifice contrived by loosening a screw in the cover of the pump.

On starting the engine, two stop-cocks, one at the lowest part of the syphon leg near the cylinder, and the other between the valves of the feed-pump, are opened. The engine then works as a high-pressure engine, until the boiler and cylinder are cleared of air and the condensing pipes of water. This being effected, the stop-cocks are closed, and after a few revolutions a vacuum begins to be formed, which increases until the limit arising from leakage of air and the temperature of the interior of the condensing pipe is attained.

The very small size of the air-pump would render the above arrangement quite abortive, if any considerable quantity of air leaked into the condenser. Nevertheless it was found that when the engine was working at one-horse power including friction, that is, raising 33,000 lbs. one foot high per minute, a vacuum of 23 inches could be maintained; the barometer at the same time standing at 29 inches. This single experiment demonstrates, in the author's opinion, the practicability of the system of surface condensation as adopted in the present instance; and shews also that it must speedily supersede the method at present used. A vacuum of 23 inches may indeed be considered an extraordinary result, when the smallness of the air-pump is considered, and when the leakage of air arising from a variety of junctions and stop-cocks, and

particularly from the stuffing-box of the piston-rod, is taken into account. Where these disadvantages obviated, as they might easily be, there is little doubt that the vacuum would equal that of most condensing engines. It is therefore concluded that one iron pipe, 10 feet long and 1½ inch diameter, is sufficient to effect adequate condensation for a one-horse power engine; and that, of course, 100 such pipes would answer for a 100-horse power engine.

It will hardly be necessary to urge on practical engineers the immense importance of surface condensation if once practically carried out. The disadvantages of the present system are well known: the boiler is turned into an evaporating basin, on the sides of which a hard deposit of carbonate of lime is formed; or, if this is avoided, it gradually becomes filled with the saturated solution of a salt. In the one case, a greatly increased consumption of fuel takes place, owing to the bad conducting power of the deposit: in the other, loss of heat and various inconveniences are the inevitable consequences of the necessity of blowing off the saturated and foul water. Besides this there is always a difficulty in keeping the water in the boiler at a proper level, entailing the necessity of a variety of contrivances for regulating the supply. When to the above objections is added the power lost in the friction of a large air-pump, and the work it has to do in pumping out the injection water, it will be allowed that a surface condenser, which obviates these disadvantages, will compete successfully with the common system, and would do so even though the vacuum were inferior to that of the ordinary condenser by half a dozen inches.

But the superiority of surface condensation does not rest with the above considerations alone. If the vacuum is imperfect through want of sufficient cooling surface, that deficiency is made up, to a considerable extent, by the higher temperature at which the water is returned to the boiler. In fact, as has been correctly observed by a previous writer, there is a limit beyond which the condensation cannot be advantageously pushed. This limit will be lower for surface than for injection condensation; as, in the latter case, the additional injection water adds to the work of the air-pump. Another and highly important consideration is, that by the proposed plan the refrigerating power of the cold water employed for condensation is more perfectly used up. In the ordinary condenser the perfection of the vacuum is that due to the lowness of the temperature of the hot well; but in the system here advocated, it is possible, by causing the current of cold water to meet that of the steam, to use the former as a refrigerating agent until it arrives at a much higher temperature than that due to the pressure of the attenuated vapour in the condenser.

Although the present experiments have not been sufficiently extended to determine with great precision the form and dimensions of a surface condenser for an engine of given power, the author thinks he can safely recommend the refrigerating surface above indicated per each horse power. A sufficiently capacious pipe should convey the steam, after passing through the cylinder, to a chest placed 12 feet above the level of the base of the air-pump. Another similar chest, with a pipe proceeding from it to the air-pump, should be placed immediately under the above, and at about the level of the foot valve. Vertical pipes about 10 feet long and 1½ or 2 inches diameter, in number equal to the

horse power at which the engine is estimated, and placed as near one another as convenient, should form a communication between the upper and lower chests. As it is of great importance that these pipes should be easily removed and put on again air-tight, short pipes might be permanently fixed to the chests for this purpose, to which the vertical condensing pipes might be conveniently attached by means of pieces of vulcanized india-rubber tubing, secured by metal clamps. The condensing pipes, thus arranged, should then be plunged into a cistern in which a current of water flows upwards. It is desirable not to allow too much water space between and around the pipes, in order that by a rapid motion of the refrigerating water it may be prevented from adhering to the surface of the pipes. The air-pump, if worked at the velocity of one stroke per second, ought to have a capacity of about 10 cubic inches for each horse power. The water passes immediately from the pump to the boiler, but the air escapes through a small orifice in the cover of the pump. To prevent the escape of water by this orifice, a contrivance like that in Cartwright's engine may be employed, consisting of a valve opening inwards, attached to a lever carrying a ball which floats on the surface of the water, so as to close the valve when the water rises.

An improved construction of surface condenser, similar in principle to the above, has been proposed by Professor Thomson. It consists of an enlargement of the cold-water pipe in the form of a large pipe or chamber, connected to that pipe by joints at the top and bottom. The chamber is closed at the ends by two plates, perforated with a number of holes to receive condensing tubes, which are proposed to be fine copper tubes as small as $\frac{1}{16}$th inch inside diameter, fitting well but not tight in the holes in the tube plates. The joints are made water-tight by a disc of india-rubber, perforated in the same manner as the tube plates, and placed below the lower and above the upper plate. A second plate may be added outside each india-rubber disc, and screwed up tight to the tube plate by means of bolts, so as to press the india-rubber well round the tubes and make a water-tight joint. The vacuum pressure, however, will probably be sufficient to keep the india-rubber tight round the tubes, and the second plates and tightening screws will then be dispensed with. The exhaust steam enters the condenser at the top, and the cold water flows upwards through the tubes. The condensed water is drawn off from the bottom by a pipe leading to the air-pump. By this plan there are no joints for leakage of external air into the vacuum, except the ordinary joints for the connexions of the exhaust pipe to the valve chest and condenser. The joints in the tube plates have water on the outside, and the vacuum of the condenser on the inside, so that any leakage through them would simply give a little injection water, to which no supporter of the present system can object; the amount of leakage may, however, be made so slight as to be practically imperceptible. It should be observed that there is an important difference between the condenser now proposed and the previous tubular condensers, in which the steam passes through a series of tubes surrounded by water, so that the deposit from the water takes place on the outside of the tubes and cannot be cleared away; whereas in the proposed condenser the conditions are reversed, and the deposit takes place inside the tubes and can be easily removed by passing a rod down the tubes

when requisite; the cover of the condenser being readily taken off for this purpose.

The further improvement of separating the work of clearing the condenser of air and drawing out the condensed water, has been proposed by Professor Thomson as follows:—"It appears to be an ill-arranged plan to pump out air and water in not very unequal volumes with a large proportion of watery vapour besides, which is the work allotted to the air-pump, so called, of an ordinary condensing engine; and true economy would probably be found in a division of labor. Whether surface condensation or injection be used, the air and water to be drawn out might readily be separated, by having a water pump employed to draw from the bottom of the condenser, of very little larger capacity than would be sufficient for all the water to be pumped out, and by having also a branch pipe from the condenser near the top leading upwards to an air-pump; this pipe being specially cooled by a separate refrigerating stream of water to itself, so that the temperature in it might be lower than it is practicable to attain in the condenser; as low, in fact, within a degree or two, as that of the cold water supply. There would thus be a much more perfect condensation in the pipe than in the condenser, and the condensed water would run down it, leaving above, at the entrance to the air-pump chiefly, air at the same pressure as the vacuum in the condenser. In an ordinary steam-engine, with injection, there would be a risk of the water rising in the condenser and choking the air-pump; but this might be avoided by supplying the condenser with a glass gauge; so that if the water rose too high, the injection stream might be diminished. Where surface condensation is used, it would still be desirable to be able to regulate the height of the water in the condenser; and for this purpose some plan of adjusting the feed-pump, to make it draw more or less as required, would be advisable, so that the pump might draw off just enough to prevent a rise of water in the condenser."

The importance of working the steam expansively is evident, whichever system of condensation is employed. In fact, when steam is properly used in the cylinder, it passes at a low temperature and pressure into the condenser, and then a good vacuum is easily attained with a comparatively small quantity of condensing water. It may here be remarked, that it would be very desirable to abandon the practice of using the same port for both the induction and eduction of the steam to and from the cylinder, since by this method the temperature of the exhaust steam is raised by coming in contact with metal which was the instant before heated by the induction steam, and the induction steam is cooled by contact with metal which has just before been exposed to the exhaust steam. No doubt a loss of elegance and compactness would result from employing separate ports, but this would be far overbalanced by the real advantages gained.

It has been proposed to employ air as the refrigerating agent for surface condensation. Could this be successfully realized, a most important practical result would be attained, for it would make the steam-engine available in localities where a good supply of water cannot be obtained.

Scientific Adjudication.

COURT OF QUEEN'S BENCH, GUILDHALL.

Saturday, June 27th, 1857.

Before Lord Campbell and a Special Jury.

THOMAS *v.* REYNOLDS.

THIS was an action for the alleged infringement by the defendant, who is a stay manufacturer at Birmingham, of a patent granted to the plaintiff, Mr. W. Thomas, of Cheapside, on the 1st December, 1846, for "improvements in machinery for sewing or stitching various fabrics." Sir F. Thesiger, Mr. Webster, and Mr. Salter, were Counsel for the plaintiff; and Mr. Atherton, Q.C., Mr. Hugh Hill, Q.C., and Mr. Hindmarch, for the defendant. Prior to the introduction of this patented machinery, which was the invention of an ingenious mechanic, Mr. Howe, of New York, it appears that attempts had been made to embroider or ornament fabrics by working in stitches by mechanical means; and it had also been proposed to unite fabrics by needles and hooks operated by mechanism; but until the introduction of Mr. Howe's invention into this country, no practically useful sewing machine had been seen in England. The plaintiff being largely engaged in the manufacture of goods in which sewing was employed, had the machine brought to his notice, and considering it might be made available for some branches of his business, invited the inventor to this country, and engaged him to adapt his invention to the sewing of stays, which, at that time, were covered with ornamental stitching. This he effected by the use of a traversing frame which held the work distended, and passed it under the action of the sewing instruments. The sewing machine proper, which formed the chief part of the patent, and which is now known as the "shuttle machine," consists mainly of a grooved needle with an eye near the point to receive a thread, and a shuttle, which in its traverse lays a thread in the loops formed by the needle thread, at the back or front face of the cloth under operation. The needle is connected to and operated by a rock lever, which causes it to pierce and carry the thread through the cloth, and then moves back out of the cloth. During this latter movement, the needle draws its thread into the form of a slack loop, and at that moment the shuttle is driven through the loop and caused to lay a thread in that loop; by which means the loop, on the completion of the return motion of the needle, is retained on the face of the cloth, and a secure stitch is produced. The cloth is then traversed forward the distance of one stitch in length, and the above-described action is repeated. While under the action of the needle, the cloth is retained

between two metal plates, which greatly facilitate the operations of the needle, and thereby insuring good work. It appeared that machines, possessing some of the essential features of Thomas's machine, had been extensively manufactured in the United States, and imported into this country by Messrs. Grover & Baker, of New York, who were licensees under Howe's American patent, and that, among others, the defendant had purchased such machines and employed them in his business. Attempts had been made to serve Mr. Baker with a notice of action, but failing this, the defendant Reynolds had been sued, and Baker had voluntarily become a party to the suit.

For the defence, it was not attempted to deny the infringement, but the validity of the patent was questioned, on the ground of want of novelty, from the publication of material parts of the plaintiff's invention in the specifications of some eight patents of prior date to the plaintiff's. Of these, the defendant relied mainly on a patent granted to John Duncan, in the year 1804, for a new mode of tambouring or raising flowers, figures, or other ornamental figures upon muslins, &c.; and on another patent granted to Messrs. Fisher and Gibbons, in the year 1844, for improvements in the manufacture of figured or ornamented lace, or net, or other fabrics. In Duncan's specification a traversing frame was shewn, for holding the cloth at tension, and presenting it to the action of a series of needles and hooks, which were thus enabled to form isolated patterns all over the fabric. This was proved by plaintiff's witnesses to be distinct from his frame, inasmuch as the traverse of Duncan's frame was necessarily limited, to suit the special work required; whereas the plaintiff's would traverse the fabric so as form a row of stitches from selvage to selvage. And further, Duncan's frame required to be moved by hand after each stitch, while plaintiff's was self-acting, and dependent on the movement of the needle and shuttle. With respect to Fisher and Gibbons's specification, it was contended that that disclosed the use of the needle and shuttle, which formed the second claim under the plaintiff's patent. It was, however, shewn by the plaintiff's witnesses, that there was a material difference between the two arrangements. That besides the one having a series of needles attached to a common bar, while in the other there was but one needle,—the form of Fisher and Gibbons's needle was inapplicable to the sewing of seams, and could only be used in connection with open fabrics like lace. The needle stem was bowed, to allow the shuttle to pass between it and the thread; and it was provided with two eyes, through which the thread passed, and by which it was held across the bow. No slack loop was therefore produced for the shuttle to pass through, as in the plaintiff's arrangement, and moreover, the needle-bar required to receive an irregular or shogging motion, in order to pass the needles through

the fabric without tearing it. The form of the stitch was the same in both arrangements, but the mode of producing it was very different. The evidence for the defence went to prove the similarity of Duncan's and the plaintiff's frame for holding and traversing the work, and the anticipation by Fisher and Gibbons of the plaintiff's claim for the needle and shuttle; their specification having contemplated, in express terms, the sewing of two fabrics together.

The leading counsel having addressed the jury on behalf of their respective clients, the learned judge summed up as follows:—

SUMMING UP.

LORD CAMPBELL.—Gentlemen of the Jury, this is an action substantially against Mr. Baker, and I am sorry to be obliged to say, that I do not think he appears before you to-day to very great advantage. A countryman of his, Mr. Howe, is the inventor of a most useful machine; and I must say, that our brethren in America distinguish themselves in every department of human genius, and in none more remarkably than in invention. Mr. Howe has discovered a sewing machine, the operation of which you have observed, and which seems greatly to improve the material advantages of mankind. It is sold to the plaintiff, who, according to our law, takes out a fresh patent for it,—it never having been practised in England before. The plaintiff is, as far as we can see, in the undisturbed possession of it for ten long years; and then Mr. Baker, of the firm of Grover and Baker, makes an invasion, I must call it, into this country, and sends machines, which were clearly framed according to Howe's invention, and upon which machines Howe's name is actually put; and they sell these machines in Birmingham and other parts of England,—they, no doubt, well knowing that Howe's patent had been purchased by Thomas, and that Thomas had been in the possession of it. Then, notice being served upon Mr. Baker that he would be sued, he leaves this country. Then the plaintiff reluctantly, but necessarily, brings an action against this stay-maker at Birmingham, who was using the machine. Nobody can blame the stay-maker morally; he bought the machine and paid for it, and was using it, but it was necessary to sue him; and then Mr. Baker comes in to defend, and what defence does he set up? Why, first, that he had not infringed Howe's patent, but had made a difference, and therefore that there was no infringement, even if Howe's patent had been valid, he having put upon the machines that he sold the name of Howe. Then his counsel, most able, most learned, and most eloquent, feels that it would not be decent to ask you, a jury of Englishmen, to say that it is not an infringement, when Baker proclaimed to all the world that it was Howe's. It is allowed that there is an infringement, and that, if the patent is valid, your verdict must be for the plaintiff. Then it was attempted to be shewn, that there was no novelty in Howe's invention which Thomas purchased; and the various specifications that are given notice of are eight in number, but only two are now relied upon; and it is for you to say whether, hearing the evidence and giving all due effect to it, taking care that no bias upon your minds should mislead your judgment, it is for you to say, upon the evidence, and upon listening to the forcible observations you have heard from Mr. Baker's counsel, whether it is proved, to your satisfaction, that either claims No. 2 or No. 3, had been anticipated—had No. 2 been anticipated by Fisher and Gibbons, and No. 3 by Duncan. Now, gentlemen, I was called upon to give an opinion about it;—I think it is a pure question of fact for the jury;—you are the constitutional judges of it, and I beg that you will be governed by your own opinion upon it: I shall merely read to you the claims of No. 2 and No. 3.

No. 2 is amended by a disclaimer, and I ask you to consider what evidence has been given on one side and on the other. No. 2 is in these words: "I claim the application of a shuttle in combination with a needle, as shewn in sheet 1 of the

drawings." Not several shuttles and needles, but as shewn in No. 1 of the drawings; and not for all purposes, but for "forming and securing loops of threads or other substances for the purpose of producing stitches, either to unite or ornament various fabrics, whatever may be the means employed for working such shuttle and needle when employed together." Then, in the disclaimer, he adds, "I do not claim the use in a machine of several needles and shuttles, nor do I claim any of the mechanical parts, separately, of which the machinery shewn in the drawings is composed."

Now, gentlemen, Mr. Carpmael and the witnesses on the part of the plaintiff have said, that Fisher and Gibbons' is essentially different from this No. 2 in Mr. Thomas's specification, and they have given you their reasons. Then, on the other side, there have been witnesses who have stated, very positively, that they are the same: form your own opinion upon it; and though it is a question of fact, and you will be governed by your own opinion, I cannot help saying, that, in my judgment upon the matter, the evidence preponderates in favor of the plaintiff, but do not be governed by that. Then the claim which is the second ground of objection is, "I claim the construction and use of the sliding frame shewn in sheet 2 of the drawings, whereby I am enabled to hold the cloth in such a manner that it can be moved in any required direction to receive straight and curved lines of stitches, and also stitches that will form various patterns of embroidery. Now it is said that Duncan's machine describes this. It is for you to form your own opinion upon that. I should have thought that Duncan's machine could not properly be called a sewing machine; but that is a matter of fact for your consideration. Mr. Carpmael, and the witnesses for the plaintiff, have stated that it is essentially different from what is stated in No. 3. The defendant's witnesses you have heard, and I must own I was a little surprised to hear that they considered that Duncan's was a sewing machine; but if it be a sewing machine, it is very wonderful that from the year 1804 to the year of grace, 1846, there was no practically useful sewing machine, either in England or America. But one of the witnesses said, that a workman reading Duncan's specification would at once find that it was a sewing machine. It is to be regretted that the world for forty years lost the advantage of such a happy invention. But, gentlemen, if you think it is substantially the same, although Mr. Howe did not copy it, or Mr. Thomas did not copy it, the law is, that being substantially the same, and being so disclosed by the specificatiou of 1804, the patent would be invalid. But I cannot help owning that I was a little surprised to hear that they could be the same, if it was necessary in the one always to stop and re-adjust the machine for any change in the pattern; whereas the other could go on and change the fabric to be sewn exactly according to the will of the workman who was superintending the machine. That would have constituted, as one would think, a material difference between them; but one of the witnesses says that that might be done even in Duncan's; that Duncan's will work vertically, laterally, and horizontally. That is contrary to the evidence given on the part of the plaintiff; but you must form your own opinion. If you think that this really was substantially the same, though unknown to Howe, and although it slept for nearly half a century, if it be substantially the same as that which is described in the claim No. 3 of Howe's invention or Thomas's patent, then your verdict upon that will be for the defendant; but if you think there is no satisfactory evidence given to you to shew that either No. 2 or No. 3 had been anticipated—that Fisher and Gibbons' patent and Duncan's are materially different from the description of the claim, either in No. 2 or in No. 3,—then your verdict will be for the plaintiff.

The jury deliberated for a few minutes.

The Foreman.—The jury find a verdict for the plaintiff.

Sir F. Thesiger.—Damages forty shillings. Your Lordship will give the usual certificates.

Lord Campbell.—All certificates.

PROVISIONAL PROTECTIONS GRANTED.

[*Case in which a Full Specification has been deposited.*]

1795. John Bourne, of Billiter-street, for an improved steam train for navigating shallow rivers.—[*Dated June 26th.*]

[*Cases in which a Provisional Specification has been deposited.*]

650. Thomas Jefferson Thompson, of Greenwood-park, Newry, Ireland, for improvements in the construction of gasometers, whereby they are rendered applicable to lighting railway carriages.—[*Dated March 5th.*]

964. John Slack, of Manchester, for improvements in lubricating certain parts of looms for weaving.—[*Dated April 6th.*]

1126. James Sharples, of Crawshaw Booth, near Rawtenstall, Lancashire, for improvements in drying cotton and other fibrous substances or materials.—[*Dated April 22nd.*]

1200. David Chadwick, of Salford, and Herbert Frost, of Manchester, for improvements in apparatus for measuring water and other liquids and gas; applicable also to the purpose of obtaining motive power.—[*Dated April 28th.*]

1274. Johann Philippe Becker, of Paris, for improvements in the mode of silvering animal, vegetable, and mineral objects.

1286. Peter Armand le Comte de Fontainemoreau, of London, for improvements in the preservation of grain and alimentary substances in general, —being a communication.

The above bear date May 6th.

1330. Peter Armand le Comte de Fontainemoreau, of London, for an improved hydraulic motor,—being a communication.

1342. William Massey, and John Smith, of Newport, Salop, for improvements in machinery for ploughing and cultivating land.

The above bear date May 12th.

1376. Henry Schmidt, of Rue St. Honoré, Paris, for a new apparatus for advertising in railway-carriages, omnibuses, cabriolets, and other vehicles, and in theatres and public places.—[*Dated May 15th.*]

1386. Henry Jones, of Birmingham, for an improvement or improvements in engines for raising beer and other liquids.

1388. George Henry Creswell, of Devonport, for improvements in apparatus for supplying ink or other mixture for stamps used in stamping letters and other articles.

1390. Charles Cowper, of Southampton-buildings, for improvements in preparing solutions and extracts of the coloring matter of madder and other tinctorial substances for dyeing and printing,—being a communication.

1392. William Hill, of Carlisle, for improvements in railway-breaks.

The above bear date May 16th.

1394. Rudolph Bodmer, of Thavies-inn, for improvements in locomotive steam-engines,—being a communication.

1396. Isac Louis Pulvermacher, of Paris, for improvements in pipes or tubes for smoking.

1398. James Apperly, and William Clissold, both of Dudbridge, Gloucestershire, for an improvement in carding-engines, and in condensers applicable thereto.

The above bear date May 18th.

1402. Thomas Welcome Roys, of Southampton, Long Island, U.S., for improvements applicable to explosive shells.

1404. Edward Alfred Cowper, of Great George-street, Westminster, for improvements in furnaces for heating air and other elastic fluids.

1406. John Hope, of Bishops Auckland, Durham, for an improved screw-nut and ratchet-brace for working the same.

1408. Jacob Ulrich Ott, of Zell, Zurich, Switzerland, and Friedrich August Moritz Udloff, of Somers Town, for improvements in ruling paper, and in the pens or instruments for the same.

1410. Maria Bounsall Rowland, of Acton Green, Middlesex, for improve-

ments in soap and detergent preparations or compounds.

The above bear date May 19th.

1412. Charles Weightman Harrison, of Woolwich, for improvements in obtaining light by electricity.

1414. Abel Foulkes, of Chester, for improvements in sewing or pointing gloves, and in machinery for such purposes.

1416. Alfred Austin Usher, of Birmingham, for a new or improved moderator lamp.

1420. Laurent Lethuillier, of Rue Marbeuf, Paris, for an improved machine for moulding and compressing bricks, tiles, and other articles made of soft materials.

1422. John Harrison, of New Church-road, South Hackney, for improvements in railway signals.

1424. Joseph Jakens, of Bury, Lancashire, for improvements applicable to printing and dyeing woven fabrics and fibrous materials.

1426. William Stettinius Clark, of High Holborn, for improvements in machines for cleaning and polishing knives,—being a communication.

1428. Edward Curtis Kemp, of Avon-place, Birmingham, for improvements in chandelier or other pendent gas-lights, and in the fittings for the same.

The above bear date May 20th.

1430. James Hopkins, of St. George's-in-the-East, and George Pearce, of Mile End, for improvements in trucks.

1432. William Owen, of Ardwick, near Manchester, for improvements in machinery or apparatus for stretching woven fabrics.

1434. William Todd, of Heywood, Lancashire, for certain improvements in the treatment of yarns or threads and in the apparatus for performing the same.

1436. William Beech, of Burslem, for improvements in generating and applying motive power.

1438. John Wesley Hackworth, of Darlington, for improvements in machinery or apparatus for forcing, lifting, and exhausting aeriform bodies and liquids applicable to blast furnaces.

The above bear date May 21st.

1440. Meyer Drukker, of London Wall, for improvements in apparatus for indicating the passage of time.

1443. William Hensman, of Linslade, Buckinghamshire, for improvements in drills for sowing seeds and depositing manure.

1445. Percival Moses Parsons, of Duke-street, Adelphi, for improvements in making moulds for casting railway chairs and other articles in metal, and in apparatus for that purpose.

1446. John Turner Wright, and Edwin Payton Wright, both of Birmingham, for a new or improved manufacture of cloths or coverings for railway trucks and other vehicles, ricks, and other such like purposes.

1447. Frederick Walton, and John Pinson, both of Wolverhampton, for new or improved machinery for stamping or raising metals.

1448. Benjamin Hornbuckle Hine, and William Onion, both of Nottingham, for improvements in knitting machinery for the manufacture of ribbed fabrics.

1449. John Ralph Engledue, and William Cullis, both of Southampton, for improvements in ventilators for ships' cabins, apartments, and places.

1450. Samuel Fox, of Deepcar Works, Sheffield, for an improvement in the manufacture of flat steel wire, used for the manufacture of the ribs and stretchers of umbrellas and parasols.

1451. Peter Effertz, of Nelson-square, Blackfriars-road, for improvements in machinery for making bricks.

1452. Anton de Schuttenbach, of St. Petersburg, for improvements in preparing fatty matters for the manufacture of candles and other purposes.

The above bear date May 22nd.

1453. William Carron, of Birmingham, for a new or improved nail, spike, or bolt, and machinery for manufacturing the same.

1454. Noël Joseph Hyppolite Duplais, of Paris, for certain improvements in the manufacture of felt hats and bonnets.

1455. Pascal Florentin Coulon, of Paris, for certain improvements in velveting paper and textile fabrics.

1456. Edwin Travis, of Oldham, Lancashire, and Joseph Louis Casartelli, of Manchester, for an improved apparatus for regulating the supply and

discharge of steam, air, water, and other fluids.

1457. John Rankin, of Manchester, for improvements in ventilators.

1458. Thomas Humphrey Roberts, of Plymouth, for machinery or apparatus for cleaning the inside of casks and puncheons.

1459. Thomas Silver, of Philadelphia, for an improved steam-engine governor.

1460. Gautier Olivier de la Barre, of Great Titchfield-street, Middlesex, for improvements in obtaining and applying motive power,—being a communication.

1461. John Phillips, of Clipston-street, Portland-road, for improved apparatus for supporting and propelling the human body in water.

The above bear date May 23rd.

1462. Thomas Bullock, of Skinner-place, Holloway, for the construction of water-closets upon the principle of self-action and self-cleansing, called "the self-cleansing water-closet."

1463. Walter James Handscombe Rodd, of Earl's-court, Westminster, for a method of sailing or propelling a vessel or vessels out of or on the surface of the water.

1464. William Robertson, of Glasgow, for improvements in pistons and in apparatus connected therewith.

1465. Schofield Crowther Sheard, and George Underwood, both of Smethwick, near Birmingham, for certain improvements in supplying boilers with water, generating steam, and consuming smoke, and which said improvements are applicable to marine, locomotive, stationary and other boilers.

1466. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved counting apparatus applicable for counting envelopes, cards, printed papers, or other articles that require to be put up in packets or parcels containing fixed numbers,—being a communication.

1468. Alphonse Coutant, of Paris, for improvements in forging and rolling iron wheels for railways.

1469. Nicolaus Charles Szerelmey, of Bermuda-place, Peckham, for improvements in preparing combinations of materials for coating wooden and iron ships or vessels.

1470. John Crossley, of St. Helen's, Lancashire, for improvements in machinery for grinding and smoothing glass, marble, and other substances.

1471. William Fox, of Boulogne-sur-mer, for improvements in the manufacture of steel pens.

1472. Henry Whatley Tyler, of Norfolk-crescent, Hyde-park, for improvements in the permanent way of railways.

1473. Henry Cogan, of Trent, Somersetshire, for an improved adjustable connection or joint, particularly applicable to agricultural implements.

1474. Richard Archibald Brooman, of Fleet-street, London, for improvements in pumps,—being a communication.

1475. Marin Joseph Alphonse Mille, of Paris, for improvements in producing gas.

1476. John Earnshaw, jun., of Ossett, near Wakefield, Yorkshire, for improvements in the toothed coverings of rag machine cylinders, and in the machinery or apparatus for preparing the same.

1477. Louis Désiré Aubert, of Paris, for improvements in fastenings for securing rails in the chairs.

1478. William Scott Underhill, of Newport, Salop, for certain improvements in wringing machines.

1479. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved mode of relieving the slide valves of steam engines from unnecessary pressure,—being a communication.

1480. Robert James Hendrie, jun., of Blossom-street, Norton Folgate, for an improvement in steam-boiler and other furnaces.

The above bear date May 25th.

1481. James Edgar Cook, of Greenock, for an improved composition for the prevention of the decay and fouling of ships' bottoms and other exposed surfaces.

1482. William Hart, of Brigg, Lincolnshire, for improvements in signal lamps.

1483. Charles David Davies, of Holloway, for improvements in the application of coir or cocoa-nut tree fibre

as a substitute for hair in the manufacture of cloths used in seed crushing.

1484. William Stettinius Clark, of High Holborn, for improvements in machines for producing artificial ices from cream and other liquids,—being a communication.

1485. William Stettinius Clark, of High Holborn, for improvements in printing presses,—being a communication.

1486. William Stettinius Clark, of High Holborn, for improvements in copying presses,—being a communication.

1487. William Stettinius Clark, and Benjamin Moore, both of High Holborn, for improvements in churns for producing butter,—being a communication.

1488. James Sutcliffe, of Manchester, for improvements in water-gauges.

1489. Robert Parkinson, and John Standish, both of Blackburn, for improvements in machinery or apparatus used in the preparation of cotton, wool, flax, or other fibrous materials to be spun.

1490. William Holland, of Birmingham, for improvements in umbrellas and parasols.

1491. Willam Irlam Ellis, of the Vulcan Foundry, near Warrington, for certain improvements in steam-engines.

1492. Henry Crompton, of Farnworth, Lancashire, for certain improvements in machinery or apparatus for stretching woven fabrics.

1493. Robert Low, of Union-street, Woolwich, and William Press, of Stepney Causeway, for a certain new improvement or new improvements in the construction of vices.

1494. James Savory, of Tewkesbury, for a machine for separating seeds, whitecoats, and dirt from wheat and seeds, awns, and dirt from barley, and for cleaning and polishing wheat, barley, and other grain fit for market.

1495. Edward Welch, of Penge, for improvements in fire-places, and flues, and apparatus connected therewith.

1496. William Sawney, of Beverley, Yorkshire, for improvements in winnowing or corn dressing machines.

1497. Jean Léonard Codet-Négrier, of Paris, for improvements in the manufacture of boots, shoes, harness, and other articles.

1498. Virginie Bacqueville-Pieters, of Paris, for improvements in outside blinds or shades for windows, doors, and other places.

1499. Randal Cresswell, of Conduit-street, Regent-street, for a new article, to be called "typha velvet," suitable for carpets, furniture hangings, wearing apparel, and other useful purposes.

1500. Randall Creswell, of Conduit-street, Regent-street, for improvements in grease or lubricating boxes for axles and other rotary parts of machinery.

1501. John Williamson, and Francis Williamson, both of Keighley, Yorkshire, John Wright, of Griffe Mill, Bradford, and Joseph Wadsworth, of Oldfield, in Keighley aforesaid, for improvements in looms.

1502. Richard Archibald Brooman, of Fleet-street, for improvements in distilling and in apparatuses employed therein,—being a communication.

1503. Ferdinand Jossa, of St. Helen's Colliery, near Bishops Auckland, for improvements in hammers worked by atmospheric pressure.

1504. Louis Joseph Almidor Danne, of Caen, France, for manufacturing gutta-percha glue and applying the said glue to various new purposes.

1505. Milivoï Petrovitch, of Belgrade, for the improvement of projectiles used with fire-arms.

1506. Thomas Grahame, of Upper Seymour-street, Portman-square, for improvements in inland navigation.

1507. Thomas Taylorson Jopling, of Sunderland, for improvements in water-gauges of steam-boilers.

1508. Edward Paige Griffiths, of High-street, Camberwell, for improvements in apparatus for beating the whites of eggs and other fluids and matters.

1509. Richard Edward Hodges, of Southampton-row, Bloomsbury, for improvements in gauges and scales.

1510. William Hale, of Swan-walk, Chelsea, for improvements in rolling iron and steel.

1511. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved method of applying

photography to the use of engravers, —being a communication.

1512. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for certain improved apparatus to be used in the manufacture of iron,—being a communication.

1513. Thomas Hart, of Watt's-terrace, Old Kent-road, for improvements in the manufacture of lamp-glasses, applicable to railway-carriage and other lamps.

The above bear date May 27th.

1514. Nathaniel Cox, of Liverpool, for improvements in railways,—being a communication.

1515. Alexander Simpson, of Chancery-lane, for a new or improved slop and toilet-pail,—being partly a communication.

The above bear date May 28th.

1516. William Wilber, of New York, for hot-air apparatus for hulling and extracting oils from oleaginous seeds.

1517. Thomas Willis, and George Chell, both of Longsight, near Manchester, for improvements in machinery for spinning, doubling, and winding yarn and thread.

1518. Charles Fleet, of Brighton, for an improvement or improvements in the manufacture of printing ink,—being a communication.

1519. Jean Salles, of Paris, for an improved apparatus for printing and stamping.

1520. James Merrylees, of Paisley, for improvements in the manufacture or production of ornamental fabrics.

1521. James Merrylees, of Paisley, for improvements in the manufacture or production of carpets and other ornamental fabrics.

The above bear date May 29th.

1523. Louis Heinemann, and Arnold Heinemann, both of Manchester, for improvements in those parts of printing machines called doctors.

1524. William Stettinius Clark, of High Holborn, for improvements in machinery for the manufacture of an instrument for sharpening watch-cleaning sticks used by watchmakers, said instrument being also applicable to the sharpening of small wooden cylinders for other purposes, such as lead pencils, &c.,—being a communication.

1525. Pierre Benoit Chapuis, of Lyons, France, for improvements in machinery for manufacturing ribbons, trimmings, fringes, and healds.

1526. Edouard Alexandre, of Paris, for improvements in the manufacture of organs and other similar musical instruments.

1527. Moses Clark, of St. Mary Cray, Henry Oldfield, of Foots Cray, and William Salmon, of Foots Cray, all in Kent, for improvements in machinery or apparatus used in the manufacture of paper.

1528. Dr. Hermann Bleibtreu, of the Alum Works, near Bonn-on-the-Rhine, for a new mode of preparing coke for metallurgical processes.

1529. Lewis Fenton Kenny, of Stanley-street, Pimlico, for improvements in window-frames and sashes.

1530. John James, and William Daykin Grimshaw, both of Southampton, for an improved screw propeller for propelling ships or other navigable vessels through water.

1531. Ralph Errington Ridley, of Hexham, Northumberland, for improvements in the permanent way of railways.

1532. Jean Salles, of Paris, for an improved safety lock.

1533. Ferdinand Charles Warlich, of Hope Cottage, Kentish Town, for improvements in generating steam.

1534. George Watson Pye, and Thomas Oldknow, both of Nottingham, for improvements in machinery for manufacturing bobbin net or twist lace.

1535. George Hornsey, of Southampton, for improved apparatus for the engine-rooms of steam-vessels for communicating signals and orders from the captain on deck to the engineer or attendant below.

1536. Thomas Sherratt, of South-square, Gray's-inn, for improvements in time-keepers.

1537. Thomas Wilson, of Bradmore House, Chiswick, for improvements in floating bodies used in washing-machines.

The above bear date May 30th.

1538. Lazare Prosper Lambert-Alexandre, and Louis Pierre Felix Mallet,

both of Paris, for improvements in machinery for propelling vessels.

1539. Frank Perks Fellows, of Wolverhampton, for improvements in the manufacture of hinges, cocks, and other jointed articles, or articles of which one part is required to be capable of turning upon or in another part of the same article.

1540. William Henry Walenn, of Chancery-lane, for improvements in the electric deposition of metals and metallic alloys.

1541. John Aiken Salmon, of Glasgow, for improvements in steam-engines and in apparatus for feeding boilers, and in furnaces.

1542. Louis Laurent Bequemie, of Rue de la Douane, Paris, for improvements in cocks,—being a communication.

1543. George Tingle, of Northwood, near Hanley, Staffordshire, for an improvement or improvements in machinery for the manufacture of articles from clay and other plastic substances.

1545. Henry Thompson, of Regent-street, for improvements in pianofortes.

1546. Thomas Slater, of Hull, for an improvement in ploughs.

1547. Stanislaus Hoga, of Marylebone-street, Middlesex, for an improvement in coating the surfaces of the cells of galvanic batteries, and also the surfaces of crucibles.

1548. Richard Wright, of Brighton, for improvements in steam-boilers.

1549. Henry Laurent Muller, jun., of Paris, for a new means of advertising.

The above bear date June 1st.

1550. Charles Shaw, of Birmingham, for a new or improved manufacture of matts for photographic and other pictures.

1551. William Stettinius Clark, and Benjamin Moore, of High Holborn, for improvements in animal traps.

1552. Peter Armand le Comte de Fontainemoreau, of London, for improved means of floating submerged bodies,—being a communication.

1553. Newton Bentley, of Salford, and John Alcock, of Little Bolton, for improvements in machinery or apparatus for forging and stamping metals,—which is also applicable to pile-driving, crushing ores and seeds, beetling and fulling woven fabrics and other similar purposes.

1554. James Allen, and John Gibson, both of Manchester, for an improved union joint.

1555. James Stevens, of the Darlington Works, Southwark Bridge-road, for improvements in water gas-meters.

1556. Nicolino Corrado, of Cardington-street, Hampstead-road, for improvements in purifying fatty matters.

The above bear date June 2nd.

1557. Peter Rothwell Arrowsmith, and Robert Caunce, both of Bolton-le-Moors, for certain improvements in machinery for carding cotton and other fibrous materials.

1558. Paul Emile Chappuis, of Fleet-street, for improvements in stereoscopes.

1559. Edmond Roy, of Paris, for improvements in the construction of railway vehicles for the special purpose of allowing them to run freely on short curved lines.

1560. Charles Robertson, of London, for an apparatus for cleaning the bottoms of iron ships while afloat.

1561. Samuel Lees, James Lees, and Frederick Lees, all of Rochdale, Lancashire, for improvements in machinery for warping cotton, worsted, and other fibrous substances.

1562. William Jones, of Kelvey Cottage, Swansea, for improvements in heating and compressing artificial fuel.

1563. Samuel Morand, of Manchester, for improvements in apparatus used for stretching and drying fabrics.

1564. George Remington, of Hereford-square, Old Brompton, and John Barton Balcombe, of Sutherland-terrace, Loughborough Park, Brixton, for improvements in locomotive engines applicable to common roads.

1565. George Deeley, of West Bromwich, for improved means for preventing the explosion of steam boilers.

1566. Richard Archibald Brooman, of Fleet-street, for improvements in gas-burners,—being a communication.

1567. John Jobson, of Dover, for improvements in oil-cans or feeders.

1568. William Barr, of Panton-street, Haymarket, for improvements in actual measurement for "delineating garments,"—being a communication.

The above bear date June 3rd.

1569. Laurent Prosper Therrin, of Grand Rue Dieppe, Seine Inférieure, France, for improvements in railway breaks, applicable to railway carriages, called railway lever breaks.

1570. Henry Constantine Jennings, of Great Tower-street, for improvements in the manufacture of paper, papier-maché, and other similar substances.

1571. Cherie Martel, of Boulogne-sur-Mer, for an improvement in fire-arms.

1572. Victor Blumberg, of Bloomfield Lodge, Notting-hill, for improvements in the manufacture of billiard-tables.

1573. William Miller, of Buckingham-street, Strand, for improvements in the manufacture of sugar, and in the apparatus used therein.

1574. William Harding, of Forest-hill, for an improvement in pistol holsters.

1575. Thomas Welcome Roys, of Southampton, Long Island, U.S.A., for improvements applicable to fire-arms.

1576. James King, of Oxford, for improvements in the manufacture of shirts.

1577. Thomas Latham Boote, and Richard Boote, both of Burslem, for improvements in the manufacture of ornamental pottery and articles made from clay and other like plastic materials.

The above bear date June 4th.

1578. Robert Hanham Collyer, of Park-road, Regent's-park, for an improved mode of preparing the residue of beet-root, mangel wurtzel, and other species of the genus betâ left in sugar-making and distillation, to be used as material in making paper, papier-maché, millboard, and other similar manufactures.

1579. Richard Roberts, of Heaton Norris, Lancashire, and Wright Shaw, and Samuel Shaw, both of Gee-cross, Cheshire, for improvements in machinery for weaving and folding fabrics.

1580. Edouard Roussille, of Jurançon, near Pau, France, for improvements in manufacturing stearic acid.

1581. Joseph Etienne Marie Jean Clair, of Annonay, France, for certain improvements in propelling on water and in the air,—being a communication.

1582. Thomas Wheelhouse, of Salford, near Manchester, and John Greenwood, of Pendleton, for improvements in ventilating vehicles or carriages in motion.

1583. Henry Schmidt, of Surrey-street, Strand, for the new cork roller for lithographic printing,—being a communication.

1584. George Collier, of Halifax, for improvements in preparing printed or parti-colored yarns for manufacture into fabrics.

1585. Ferdinand Jossa, of St. Helen's Colliery, near Bishops Auckland, Durham, for improvements in uniting iron and steel.

1586. John Jordan, of Liverpool, for improvements in the construction of iron ships or vessels.

1587. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the manufacture of paper, papier-maché, cardboard, and other similar articles,—being a communication.

1588. James Morris, of Clapham, for certain improvements in connecting the rails of railways, and in supporting the same.

1589. Edmund Knowles Muspratt, of Liverpool, and Balthasar Wilhelm Gerland, of Greenheys, Manchester, for improvements in treating waste liquors produced in the manufacture of chlorine, and in separating nickel, cobalt, and copper, from liquors containing them in combination with manganese and iron.

The above bear date June 5th.

1590. Thomas George Shaw, of Dartmouth-row, Blackheath, for improvements in bedsteads,—being a communication.

1591. Frederick Oldfield Ward, of Cork-street, Burlington-gardens, and Frederick Wynauts, of the Rue de la Paix, Ixelles-lez-Bruxelles, for improvements in manufacturing manure and obtaining accessory products.

1592. Hiram Powers, of Florence, for an improved machine for punching, stamping, or cutting metals and other substances.

1593. Rudolph Dinglinger, of Berlin, for improvements in pumps; which improvements are also applicable to steam-engines.

1594. Edward Hirst Hudson, of Burley, Yorkshire, for improvements in means

or apparatus to prevent driving straps lapping on the shafting when they shift off their pulleys.

1595. Henri Joseph Noé, of Paris, for improvements in portable stereoscopes.

1596. Joseph Rogers, of Bartholomew-close, for improvements in machinery for winding or folding drapery and other like goods.

1597. Edward Edwards, of Englefield-terrace, De Beauvoir Town, for an improved mode of fastening stair-rods and other rods.

1598. Amory Fairbanks Sherman, of Roxbury, Massachusetts, U.S.A., for improvements in machinery for breaking, hatchelling, roving, spinning, and tarring hemp, flax, manilla, or any fibrous material or materials.

1599. Alfred Jean Vincent Dopter, of Paris, for improvements in ornamenting cloth, wood, metal, leather, and other surfaces.

The above bear date June 6th.

1601. Donald Bethune, of Cambridge-terrace, Hyde-park, for improvements in apparatus for preventing or consuming smoke in furnaces and chimneys.

1602. John Brown, of Golds-green, West Bromwich, for certain improvements adapted to the prevention of steam-boiler explosions.

1603. Edgar Brooks, of Birmingham, for a new or improved manufacture of gun-barrels and other articles of like manufacture.

The above bear date June 8th.

1604. John Bickford, of Crediton, Devonshire, for improvements in machinery for cutting gutters for irrigating land, and for cutting other surface drains or gutters.

1605. William Wright, of Newcastle-on-Tyne, for improvements in apparatus for annealing glass in ovens.

1606. William Wright, of Newcastle-on-Tyne, for improvements in apparatus for feeding fires and furnaces with fuel.

1607. John Robertson, of Valley-field, Mid-Lothian, N.B., for improvements in machinery or apparatus for treating or preparing and boiling rags and other materials.

1608. Isaac Whitesmith, and William Whitesmith, both of Glasgow, for improvements in weaving.

1609. Joseph Henry Tuck, of Pall-mall, for improvements in the application of light to facilitate operations under water.

1610. Clement Auguste Kurtz, and Louis Alcide Nori, both of Paris, for improvements in extracting the coloring matter from gum-lac and other similar substances, and in treating the residues thereof.

1611. Peter Armand Le Comte de Fontainemoreau, of South-street, for improvements in the construction of axle-bearings,—being a communication.

1613. Richard Archibald Brooman, of Fleet-street, for improvements in furnaces,—being a communication.

1614. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved arrangement or construction of cut-off gear for steam-engines,—being a communication.

1615. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved life-boat,—being a communication.

1616. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved construction of faucet or cock,—being a communication.

1618. George Mumby, of Cloudesley-square, Islington, for improvements in machinery for sewing, embroidering, and other ornamental work.

1619. Joseph Augustus Burdon, of Paris, for certain improvements in apparatus for producing expansion in steam and other motive-power engines.

1620. George Baxter, of Northampton-square, for improvements in printing in colors.

1621. Thomas Daniel, of Darley Mills, near Derby, for improvements in drawing-frames.

The above bear date June 9th.

1623. James Brown, of Aldgate, for an improvement in the manufacture of paper.

1624. Joseph Sharp Bailey, of Keighley, Yorkshire, for improvements in machinery for combing wool and other fibrous materials.

1625. Griffith Jarrett, of London, for improvements in apparatus for print-

ing or endorsing in colors on paper or other surfaces,—being improvements upon the invention secured to him by letters patent dated the 29th day of July, 1853.

1626. Maxwell Miller, of Glasgow, for improvements in cocks, taps, or valves.

1627. William Gorse, and Samuel Pollock, both of Birmingham, for new or improved machinery for the manufacture of bricks and other articles of like manufacture.

1628. Thomas Humphrey Roberts, of Stonehouse, Devonshire, for improvements in the manufacture of casks.

1629. George Sampson, and Joseph Sampson, both of Bradford, Yorkshire, and Elijah Ledger, of Lofthouse, near Wakefield, for improvements in means or apparatus for effecting the folding or rigging of woven fabrics.

1630. Arthur Dunn, of Dalston, for an improvement in preparing and packing tooth powder.

1631. Michael Puddefoot, of Queen's-terrace, Woolwich-road, for improvements in mowing machines.

1632. Etienne Lemoine, of Paris, for improvements in gas-meters.

1633. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in reaping machines,—being a communication.

1634. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the construction and mode of propelling and steering navigable vessels,—being a communication.

1635. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in printing machinery,—being a communication.

The above bear date June 10th.

1636. George Farrell Remfry, of Riches Court, Lime-street, for an improved apparatus for supporting, protecting, and propelling the human body in water.

1637. Arthur Folson, of Boston, U.S.A., for improvements in the construction of tunnels or ways under water.

1638. Daniel Joseph Daly, of Cork, Ireland, for improvements in venting casks and in preserving them from bursting by the action of the liquors contained therein.

1639. James Robertson, of Glasgow, for improvements in lifting, lowering, transporting, and regulating the motion of heavy bodies.

1640. James Shaw, and Hugh Shaw, both of Waterhead Mill, near Oldham, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.

1641. Josiah Latimer Clark, of Adelaide-road, Haverstock-hill, for improvements in apparatus for conveying letters or parcels between places by the pressure of air and vacuum.

1643. William Wilkins, of Leicester, for improvements in machinery for the manufacture of looped fabrics.

The above bear date June 11th.

1645. Joseph Whitworth, of Manchester, for improvements in ordnance, fire-arms, and projectiles, and in machinery employed in their manufacture.

1646. James Buchanan, of Glasgow, for improvements in the manufacture and finishing of heddles or healds for weaving; parts of which improvements are applicable to the preparing and weaving of fibrous materials.

1647. Thomas Rutter, and James Banister, both of Birmingham, for improvements in umbrellas and parasols.

1649. George Davies, of Serle-street, for improved apparatus for weighing grain and other articles, to be called "the electro-magnetic grain scale,"—being a communication.

1650. Benjamin Noakes, and Frederic John Wood, both of Spa-road, Surrey, for a method of, and apparatus to be employed in, the sealing of the joints in metallic casks and other similar vessels.

1651. Edward Brasier, of Stepney, for improvements in treating flax, hemp, and other vegetable fibres, and in the machinery employed therein.

1652. Charles d'Ambly, of Stuttgart, Wurtemberg, for improvements in cutting and preparing horn,—being a communication.

1653. Carl Gustaf Carleman, of Jewin-crescent, for improvements in submerged propellers for propelling vessels.

1654. Malcolm Macdonald, of Glasgow, for improvements in washing, bleach-

ing, cleansing, and preparing textile fabrics and materials.

1655. Eugène Barsanti, and Felix Matteucci, both of Florence, for improved apparatus for obtaining motive power from gases.

1656. Clarance Brazil, of Chorley, Lancashire, for improvements in looms for weaving.

1657. George Lister, of Rivers, near Dursley, Gloucestershire, for an improvement in carding engines.

The above bear date June 12th.

1660. Robert Mushet, of Coleford, Gloucestershire, for improvements in the manufacture of cast steel.

1661. John King, of Glasgow, for improvements in the manufacture or production of collars, cuffs, and similar articles of ladies' dress.

1662. Chapman March, of Alwalton Mills, Huntingdonshire, for improvements in obtaining motive power.

1663. Etienne Cominal, of Paris, for improvements in printing shawls and other tissues.

1664. Thomas Morton Jones, of Cambridge-villas, Fulham, for improvements in apparatus for cutting and gathering fruit and flowers.

1665. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for an improvement in the manufacture of sulphuric acid,—being a communication.

1666. Helmuth Gartner, of Mount-gardens, Lambeth, for an improved construction of engine for raising and discharging water.

The above bear date June 13th.

1667. Thomas Heaton, of Bolton, Lancashire, for improvements in self-acting doors and gateways.

1668. Charles Vero, and James Everitt, both of Atherstone, Warwickshire, for improvements in the manufacture of hats and other coverings for the head, and in machinery or apparatus to be employed in the said manufacture.

1669. John Henry Johnson, of Lincoln's-inn-fields, for improvements in quadrants, sextants, and other similar instruments,—being a communication.

1671. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in puddling iron, and in the furnaces and apparatus employed for the purpose,—being a communication.

1672. Frederick Levick, jun., and John James, both of Cwm Celyn and Blaina Iron Works, Monmouthshire, for an improved construction of hot blast stove.

1673. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved means of registering the performance of railway trains,—being a communication.

1674. Edmund Thompson, of Barnard's-terrace, Scawby-with-Sturton, Lincolnshire, for improvements in piano-forte hammers.

1675. William Young, of Queen-street, Cheapside, for improvements in lamps and burners.

The above bear date June 15th.

1677. Thomas Wilkes Lord, of Leeds, for a certain improvement in machinery for carding flax, tow, and other fibrous substances.

1679. Stephen Holman, of Douglas-street, New Cross, for improvements in force pumps.

1681. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved mode of, and apparatus for, feeding in fuel to furnaces and fire-boxes,—being a communication.

1683. William Alexander Edwards, of Hereford-cottage, Denmark-road, Camberwell, for improvements in apparatus for separating iron and other matters from ores and other substances.

1684. John Fowler, jun., of Cornhill, Robert Burton, of Maberley-terrace, Ball's-pond-road, & Thomas Clarke, of St. James's-place, Hackney-road, for improvements in the construction and arrangement of locomotive and other carriages, to facilitate their movement on common roads and other surfaces.

1685. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in the construction of wheels and axle-boxes,—being a communication.

1686. Joseph Ellis, of Brighton, for improvements in apparatus to be used for decanting wine and other liquids, and for drawing corks from bottles.

1687. William Barnard de Blaquiere, of Pall-Mall, for improvements in connecting the ends of submarine electric telegraph cables.

1688. Richard Goulding, of Bonner-road, Victoria-park, for improvements in the extraction of gold and silver and other metals.

The above bear date June 16th.

1689. Philipp Kürten, of Cologne, for an improved process of manufacturing mottled soap.

1690. John Smith, of Oldham, for improvements in the manufacture of woven fabrics.

1691. William Hodgson, and Henry Hodgson, both of Bradford, Yorkshire, for an improved lubricator or oiler by means of force-pumps or valves.

1692. Salomon Sturm, and Henry Emile Bour, both of Paris, for improvements in optical lenses, and in machines for manufacturing the same.

1693. Henry Hosch, of Old Jewry-chambers, for an improved shirt cutting machine,—being a communication.

1695. Frederick Warner, of Jewin-crescent, Cripplegate, for improvements in supplying water to water-closets and other vessels.

1696. Gustave Marqfoy, of Bordeaux, for improvements in actuating railway signals.

1697. Henry Brinsmead, of Fore-street, Ipswich, for improvements in machinery for dressing corn.

1698. Frederick Ransome, of Ipswich, for improvements in moulding plastic materials.

1699. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in machinery for forging nails and other articles,—being a communication.

1700. Henry Hibbert, of Salford, and Henry Richardson, of Manchester, for improvements in finishing or polishing yarns or threads.

The above bear date June 17th.

1701. George Pemberton Clark, of Newark, New Jersey, U.S., for an improved safety-valve for steam-boilers.

1702. Thomas Lowell Ralph, and Thomas Lowell Ralph, the younger, both of Birmingham, for an improvement or improvements in the manufacture of metallic tubes.

1703. Thomas Ward, of Great Bridge, Staffordshire, for an improvement or improvements in the manufacture of strip and hoop iron.

1704. Edward Sykes, and Matthew William Crawford, both of Glossop, Derbyshire, for certain improvements in the construction and arrangement of the pans or vessels, and the furnaces and flues, to be employed for the purposes of soap boiling, tallow-melting, bone boiling, dreg boiling, and other similar offensive processes.

1705. William Joseph Thompson, of North Shields, for improvements in machinery for preparing small coal and other matters to be used as fuel, —being a communication.

1707. George Washington Charlwood, of Tavistock-row, Covent-garden, for improvements in machines for mowing and reaping,—being a communication.

1708. Horace Hollister Day, of New York, for improvements in preparing and vulcanizing india-rubber, gutta-percha, or other analogous gums,—being a communication.

1709. Horace Hollister Day, of New York, for improvements in the manufacture of elastic fabrics.

The above bear date June 18th.

1711. James Champion, of Manchester, for improved arrangements of spindles and flyers, applicable to machinery or apparatus for preparing, spinning, and doubling fibrous materials.

1712. Simon Pincoffs, of Manchester, for improvements in treating madder, munjeet, or any of their preparations.

1713. Thomas Spencer, of Southampton-place, Euston-square, for certain improvements in the purification of water, and other fluid and gaseous bodies.

1714. Joseph Hill, of Mount Pleasant, near Ferry Hill, Durham, for improvements in the permanent way of railways.

1715. John Henry Johnson, of Lincoln's-inn-fields, for improvements in pressure gauges,—being a communication.

1716. Herman Jaeger, of the London Coffee-house, for improvements in

looms for weaving,—being a communication.

1717. Horace Hollister Day, of New York, for an improved method of treating or purifying gutta-percha,—being a communication.

1718. John Dunnell Garrett, of Saxmundham, for an improved construction of horse-hoe.

1719. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the construction of railway crossings,—being a communication.

1720. Robert Rennie, of Netherwood, Dumbarton, N.B., for improvements in self-acting trap-doors for mines.

The above bear date June 19th.

1721. Edward Kirk, James Leadbetter, and Charles Wilson, all of Leeds, for certain improvements in the manufacture of trunks, boxes, and other similar depositories.

1722. William Wright, of Sheffield, for improvements in flushing apparatuses applicable to cisterns and water-closets.

1723. Edward Vincent Gardner, of Norfolk-street, Middlesex Hospital, for improvements in the means employed for burning fuel and in the distribution of heat.

1724. Samuel Fox, of Deepcar, Sheffield, for improvements in fly presses.

1725. Thomas Grahame, of Upper Seymour-street, Portman-square, for improvements in facilitating the passage of carriages on inclines of railways.

1726. Samuel Fox, of Deepcar, Sheffield, for improvements in the manufacture of umbrellas and parasols.

1727. Henry Dunington, of Nottingham, for an improvement in the manufacture of cotton and silk and other warp pile fabrics.

1729. Edwin Clark, of Great George-street, Westminster, and Joseph Henry Tuck, of Pall-Mall, for improvements in blocking or supporting ships and other vessels for the purpose of docking them.

1730. Joseph White, of Coventry, for improvements in escapements for chronometers and other time-keepers.

1731. Lockington St. Lawrence Bunn, of Walbrook, for improvements in the manufacture of Wellington boots.

1732. William Rothwell Lomax, of Albion Villas, Hammersmith, for improvements in governors and pressure-gauges.

1733. Thomas Ford Caldicott, of Boston, U.S., for improvements in planes,—being a communication.

1735. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for certain improvements in looms for circular weaving, partly applicable to other purposes,—being a communication.

1736. James Gascoigne Lynde, of Great Queen-street, Westminster, for improved means for detecting and preventing the waste of water in cisterns.

1737. Charles Fletcher, of Gloucester, for improved machinery for making bricks, tiles, and other articles of clay or plastic materials.

1738. George W. La Baw, of Jersey City, U.S.A., for operating the sails of vessels from the deck by means of vertical shafts.

The above bear date June 20th.

1739. Peter Armand le Comte de Fontainemoreau, of Paris, for an improved propeller,—being a communication.

1740. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for cutting files,—being a communication.

1741. John Norris, jun., and George Worstenholme, both of Birmingham, for improvements in machinery for making nails, bolts, spikes, screws, rivets, and screw-blanks.

1742. Sir Francis Charles Knowles, of Lovell-hill, Berks, for the manufacture of aluminium and of certain reagents to be used therein.

1743. Richard Murdoch, of Baltimore, U.S.A., for improved running gear for vehicles.

1745. Thomas Mackenzie, of Rathbone-place, Oxford-street, for improvements in the internal decorations of those parts of buildings to which window draperies are to be affixed; and in the arrangement and construction of the curtain fixtures.

The above bear date June 22nd.

1746. William Knapton, of the Albion Foundry, Monk-bar, York, for an improved machine for drilling holes in metal and other substances.—*Dated June 22nd.*

1747. Thomas Cooper Bridgman, of Bury St. Edmunds, for improvements in the construction of screens, riddles, or sieves.
1749. Richard Shaw, of Holme Lodge, near Burnley, Lancashire, and John Robinson, of Lower House, near Burnley, for certain improvements in machinery for preparing cotton and other fibrous materials.
1750. Duncan Proudfoot, of Glasgow, for improvements in drying and preparing garancine.
1751. James Hinks, of Birmingham, and James Syson Nibbs, of Handsworth, Staffordshire, for improvements in securing and liberating the corks or stoppers of bottles, and in the construction of the necks of bottles, for facilitating the securing and liberating of corks and stoppers.
1752. Daniel Evans, of New Town, Stratford, Essex, for improvements in locomotive and other furnaces, and in heating water to be supplied to steam-boilers.
1753. Richard Archibald Brooman, of Fleet-street, for improvements in breech-loading fire-arms,—being a communication.
1754. Joseph Scipion Rousselot, of Paris, for an improved method of obtaining motive power, and engine for applying the same.
1755. Richard Archibald Brooman, of Fleet-street, for an improved method of engraving and of copying figures, patterns, and other devices,—being a communication.
1756. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in generating or obtaining motive power,—being a communication.
1757. Edward Woolley, of High-street, Marylebone, for an indicator for registering the names of persons occupying chambers and other apartments or offices, and for signifying whether such persons are in or out, and at what time they will return.

The above bear date June 23rd.

1760. Charles Herault, of Paris, for improvements in apparatus for producing aërated waters,—being a communication.
1761. Robert Mallet, of Bridge-street, Westminster, for improvements in tiles and coverings for roofs and other parts of buildings.

The above bear date June 24th.

New Patents.

Sealed under Patent Law Amendment Act, 1858.

1856.

2895. W. S. Clark.
3050. William Mc Naught.
3053. G. A. G. Nani.
3055. J. S. Barraclough.
3059. C. F. Varley.
3067. F. W. Campin.
3076. George White.
3079. J. Petrie and W. Mc Naught.
3083. J. C. Wagstaff.
3085. Joseph Morel.
3087. Horace Vaughn.
3088. J. H. G. Wells.
3094. R. A. Brooman.

1857.

1. J. T. Pitman.
2. C. C. Reinhardt.
7. F. H. Maberly.
8. Frederick Ayckbourn.
9. F. S. Stott.
10. Anthony Lorimier.
11. W. H. Phillips.
12. John Fowler, jun.
25. James Harris.
28. L. Wa'kins.
32. R. A. Brooman.
33. Christopher Binks.
34. Christopher Binks.
36. J. E. and B. Ingham.
43. J. M. Hyde.
44. F. F. Dumarchey, S. Levy, and J. Mayer.
51. C. E. Wright.
52. R. A. Brooman.
54. Matthew Trattles.
58. James Morris.
61. W. Y. Smith.
63. G. P. Cooper.
67. E. J. Hughes.
68. James Harris.

69. Alexander Mc Donald.
76. J. R. Day and J. L. Hinks.
79. J. H. Johnson.
83. J. Bagshaw and J. P. Harris.
84. J. and C. Gratrix.
85. J. L. Brethon.
86. D. D. Kyle.
89. James Hodgson.
90. F. X. Kukla.
91. C. R. Olliffe.
92. J. F. Porter.
94. William Watt.
95. R. A. Brooman.
104. Alfred Bower.
105. J. Hinks and G. Wells.
106. W. Thurtell, jun.
107. William Gossage.
109. Michael Potter.
113. Robert Russell.
116. J. C. Haddan.
120. A. C. Hobbs.
121. D. H. Fowler.
122. G. Parker and W. Martin.
126. Francis Watkins.
128. Julius Homan.
129. George Bedson.
135. H. H. Henson.
136. G. S. Moore.
139. C. F. Vasserot.
142. C. F. Vasserot.
144. Peter Walker.
150. John Long.
154. John Haswell.
158. John Bird.
160. Frederick Walton.
162. W. E. Newton.
166. V. A. Kientzy.
169. W. H. Barlow and H. Woodhouse.
172. J. H. Johnson.
174. J. Massey and J. Hargreaves, jun.
179. Samuel Dyer.
182. Samuel Neville.
185. Henry Cater.
188. F. A. N. D'elsarte and E. Valin.
200. J. G. Marshall.
202. A. Hemingway and T. Wheatley.
215. John Whines.
222. W. Stubbs and J. Burrows.
224. John Fortescue.
228. R. A. Brooman.
230. W. H. Brown.
235 J. S. Crosland.
243. J. Elce and J. Hewitt.
244. Robert Harlow.
245. Charles Whowell.
253. J. L. Norton.
255. J. L. Norton.
262. Arthur Malins.
272. Samuel Montagu.
285. J. A. Williams.
292. J. M. Worrall.
302. B. Hodgson and J. Carter.
312 James Taylor.
313. James Taylor.
316. Julian Bernard.
326. A. V. Newton.
343. George Wright.
346. Pierre Poisson.
452. J. Quick and A. Fraser.
458. Charles Cowper.
477. T. W. Davenport, and S. Cole.
493. William Oakes.
501. J. Glover and J. Bold.
530. C. H. Murray.
544. George Mc Callan.
574. David Davies.
641. William Muir.
657. F. A. Calvert.
715. George Travis.
750. W. E. Newton.
757. John Millar.
763. J. T. and G. Wilkes.
781. Charles Weiss.
795. George Perrott.
806. Edmund Hyde.
826. C. F. L. Oudry.
840. S. M. Allaire.
876. Joseph Scott.
930. Arthur Paget.
947. Emile Testelin.
949. William Sumner.
966. Charles Burrell.
1032. Henry Adcock.
1051. John Rubery.
1105. Thomas Sanderson.
1110. Robert Tindall, jun.
1119. A. F. Sherman.
1123. J. Chanter and D. Annan.
1125. Daniel Colladon.
1133. J. H. Johnson.
1150. Rudolph Bodmer.
1174. William Cory, jun.
1175. Rev. James Burrow.
1184. P. A. Le Comte de Fontainemoreau.
1219. W. E. Newton.
1244. B. C. Tilghman.
1245. John Marland.
1251. A. Gatti.
1273. Levi Bissell.
1282. G. T. Bousfield.
1284. W. E. Newton.
1340. J. R. Cochrane.
1350. R. S. Newall.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S
London Journal of Arts and Sciences.

NEW SERIES.—No. XXXIII.

REPORT OF THE COMMISSIONERS OF PATENTS FOR INVENTIONS, 1856.

THE fourth Report of the Patent Commissioners to Parliament, differs very little from its predecessors, as it deals in nothing but statistics, and offers no suggestion for, or prospect of, a change of any kind in the administration of the patent law: in the judgment, therefore, of the Commissioners, we may conclude that the system is perfect. The number of applications for patents appears still upon the increase, for against 2,958, the number recorded in the year 1855, there were 3,106 applications in 1856. Of these there were 2,048 patents completed and specified; while, in 1855, the number was 1,989. This is very satisfactory, for it indicates not merely a fertility of invention, but also proves that the commercial prosperity of the country is well sustained. With respect to those patents whose time for the payment of the additional tax of £50, to keep them in force, has expired since the making up of the last published accounts of the office, the Report says, "two thousand and thirty-three patents bear date between the 1st July, 1853, and the 30th June, 1854: the payment of the additional stamp duty of £50 has been made on 584 of the number, and 1,440 have become void by reason of non-payment." This fact exposes the hitherto unanswerable fallacy of those sophists who, in decrying the patent system, were ever ready to maintain that not one in one hundred patents is worth, to the inventor, the fees which he paid in obtaining it; for here is proof that nearly one-third, after a three years' public trial, have stood the test; notwithstanding the current of invention, which has been flowing steadily onward, must have superseded many schemes, valuable perhaps for a time, but which have served the purpose of their authors, and are now become useless. It is well that the patentee should receive from this tax a good turn, however slight, for it most certainly inflicts upon him grievous injustice, not merely to the extent of the money payment, for which he receives no equivalent, but by reason of the vexatious mode in which it is levied. Were it simply a debt to the state, to be collected like any other tax, there would be enough to complain of on the score of class taxation; but being levied

as it is, it is just as if a man, living in his own house, by neglecting to pay the house duty on a given day, were to forfeit his right in that property to the state. We commend this matter to the radical members of the House of Commons as far more worthy their attention than the question of remunerating the law officers of the Crown for their public services, out of the patent fund, which lately came under discussion. According to the schedule of the last report, £30,900 were received in the year 1856, on account of the progressive stamp duty of £50, as against £15,950 on the same account in the preceding year; yet with the greatly increased revenue of the Patent Office, the Commissioners have managed to keep down the surplus income, which, in 1855, reached £23,076 10*s.* 4*d.* to £26,714 15*s.* 5*d.* for the last year, being an increase of little more than £3,600, in spite of the gain of £17,658 4*s.* 10*d.* on the gross receipts of the previous year. It may be well to consider how this result has been attained.

In the Patent Act of 1852, provision was made, as is well known, for the printing and publishing of all specifications as they were recorded, with the view of shewing the public what schemes had already formed the subject of letters patent, and in conformity with this provision the Commissioners have printed, *in extenso*, not merely all the specifications, both provisional and complete, recorded under the new law, but they are also publishing the specifications enrolled under the old system; and in addition to this they have issued chronological, alphabetical, and subject-matter indexes, and abridgments of the specifications of selected subjects, and they also published a weekly journal.

The gross expenses incurred on this head, since October, 1852, are as follows:—

From Oct. 1st, 1852, to Dec. 31st, 1853,	Printing Specifications, &c. Lithographing Drawings, and paper for same.........	£12,020	7	9
For the year ending 1854	Ditto ditto	42,208	6	9
Ditto 1855	Ditto ditto	25,777	8	8
Ditto 1856	Ditto ditto	39,880	13	7
Making a total outlay of	....	£119,886	16	9

The mass of printed matter obtained by this large outlay has been offered to the public at such reasonable charges as to present no ground for complaint on the score of cost, but yet the sale has not so far expanded as to render it unnecessary to enquire into the policy of the whole proceeding. Now it is not to be doubted that all the publications issued by the Commissioners have some value in the eyes of inventors, and it might therefore be a question, if but a small sum were at stake, whether it would not be desirable to continue publishing at a small pecuniary loss, seeing that it is the inventor's money which is

expended for his benefit. But as the value of these works depends solely upon the use made of them by the public, and as the only available criterion of their use is the extent of their sale, we must judge from the sums realized by their sale, of their appreciation by the public. On this head, the first Report, embracing the fifteen months ending December 31st, 1853, is silent; as the sale appears, during this period, to have been entrusted to the printers, Messrs. Eyre and Spottiswoode; but as the result was very unsatisfactory, and arrangements were made to transfer this duty to the Commissioners' office, we are inclined to think that the sum realized must have been very trifling. The increased facilities offered in the following year at the Commissioners' office, coupled with the growing knowledge on the part of the public that all recent specifications were now publishing, and that indexes of patents, from the earliest periods, were to be purchased for thirty shillings, doubtless tended greatly to increase the sale. Judging, therefore, from what was realized under these more favorable circumstances, in the year 1854, we think it will be an ample allowance if we estimate the sale of the printed specifications by Messrs. Eyre & Spottiswoode, at £500. The account will then stand thus:—

For the year ending December 31st 1853		£500	0	0
Ditto	1854	834	14	0
Ditto	1855	1,236	15	2
Ditto	1856	1,361	10	0
Making the sum total produced by the sale of the Commissioners' publications		£3,932	19	2

If now we subtract this sum for the outlay as given above, we get the following startling result, viz:—

Cost of publications	£119,886	16	9
Realized by their sale	3,932	19	2
Total loss (represented by dead stock) during 4¼ years	£115,958	17	7

How long this state of things is to continue must be determined by the liberal members of the House of Commons; but while the money thus expended is drawn from the pockets of the inventive community in the shape of fines, at the expiry of the third and seventh years respectively of their patent rights, we shall consider it our duty to protest against the outlay. For our own part, we have a well-grounded conviction, that the publications, if properly managed, might, by their sale, be made to clear almost, if not entirely, their expenses; but there seems to be no disposition on the part of those in authority to secure such a result. In their present shape, the bulkiness and consequent cost of these publications, excludes them from most private libraries, and it is with difficulty that the commissioners have found gratuitous recipients for them

in the free and other public libraries of the country. The rate at which these blue books accumulate is something quite alarming to those who, like ourselves, have both to purchase and find shelves for them; for as each specification is printed in full, and has a separate pamphlet stitched in its own cover, there is an accession to ones library of about forty quarto pamphlets of various thicknesses weekly. In raising our voice against this mode of cramming the inventive mind, let it not be supposed that we are opposed to the principle of a government publication of patent inventions; on the contrary, it is a course of which we highly approve, and it was to remedy the evils which the neglect of this salutary provision occasioned, that our labors for a long series of years were directed in this journal; but such a duty ought rightly, long ago, to have been undertaken by government, instead of which obstacles were raised against private enterprise. That there is no necessity for, and indeed a great public inconvenience in publishing all specifications in full, experience has sufficiently proved; but it is as certain that great good would be derived from reliable abstracts of all patented inventions. This plan has been carried out to some extent in the United States, where the claims of specifications are annually published in full, accompanied by a diagram illustration and a slight verbal description of the patented machinery or apparatus. These abstracts, accompanied by suitable indexes, form two octavo volumes yearly, and are distributed gratuitously, and in large numbers, throughout the Union. In France, a more perfect system of publication is adopted. The specifications are given in sufficient fulness to explain the nature of the several inventions, and the mechanism described is amply illustrated, but on a smaller scale than the original drawings. They are issued in quarto volumes, and one volume in general contains the specifications of about three-quarters of a year. If this plan were adopted in England, the information required by inventors would be brought into an available form, instead of being lost, as at present, in a mountain of pamphlets. Some extra expense must necessarily be incurred in the editing of such a work, but the whole cost of its production would scarcely exceed one-tenth of the present outlay for printing; whereas the sale would be unquestionably great. We do not, however, think so reasonable a proposition will be entertained, so long as inventors quietly submit to the payment of the taxes which fall due at the third and seventh year of the term of their patents, and thus provide ample funds for the continuance of the present system of publication.

RECENT PATENTS.

To Thomas Roberts *and* John Dale, *both of Manchester, and* John Daniell Pritchard, *of Warrington, for improvements in obtaining and purifying oxalate of soda, which improvements are also applicable to the manufacture of oxalic acid.*—[Dated 21st November, 1856.]

This invention consists in submitting woody fibre or other organic substances to the combined action of caustic soda and caustic potash, at a temperature of 350° to 400° Fahr., whereby oxalate of soda in considerable amount is obtained mixed with carbonates of soda and potash; as also with a small quantity of these alkalies in the caustic state. The crude oxalate of soda thus obtained, is purified from the caustic and carbonated alkalies used, which is mixed by the process hereinafter described. But the ordinary method of separating two soluble salts, by a process of solution and crystallization, is inapplicable to this mixture, owing to the slight solubility of oxalate of soda, and the exceedingly minute state of division in which this latter salt exists when obtained by the ordinary process of crystallization,—its complete separation by this method being thus rendered impossible.

The improved process for purifying the crude salt consists in placing the mixture of oxalate of soda and caustic and carbonated alkalies, when perfectly cold, in tanks, and submitting it to the action of cold or warm water.

In this way potash, and other foreign substances, are dissolved away from the oxalate of soda, which is thus obtained in a pure, or nearly pure state, suitable for the manufacture of oxalic acid. By evaporating the wash-water the potash is recovered, so that it may be again used.

In conducting the manufacture, the inventors take a mixture of two equivalents of potash and three equivalents of soda, and after having causticised or partially causticised these alkalies, they proceed to concentrate by evaporation, until the same shall have reached a specific gravity of 1·350; but this point of concentration is not material, as these alkalies may be used either continuously above or below this point.

Woody fibre, or other organic substances (the material preferred is sawdust) is now mixed with the alkaline mixture of soda and potash, previously described; the proportions used being for every 100 parts of real alkali contained in the concentrated solution, 30 to 40 parts of sawdust or woody fibre. The sawdust is spread upon plates of iron, and the alkali, in the proportion described, is gradually and completely mixed with it, and care is taken to spread the mixture evenly over the plate, by the use of an iron rake, or by other means. So soon as this mixture shall have been effected, the temperature is raised by heated flues underneath the plates, and this heating of the mixture is continued during a period of from four to six hours, or thereabouts. The first effect of the application of heat is the evaporation of the water contained in the mixture, and after the expulsion of the water, the heat is continued with constant stirring of the mixture until it shall have reached a temperature of from 350 to 400° Fahr., at which temperature it must be carefully maintained with constant stirring, until, on inspection, the woody fibre or sawdust is found to have disappeared. This having been effected, the operation is complete, and the material produced will be found to contain a considerable amount of

oxalate of soda combined or mixed with other products. This material is called crude oxalate.

To purify the crude oxalate, it is placed, when perfectly cold, in iron tanks or other vessels, and submitted to the action of cold or warm water; and this it is preferred to do, by the use of a series of tanks, so arranged, that the partially saturated solution from the first tank, or that containing the already partially washed salt, shall flow into the second, or that containing a salt more recently subjected to the washing process, and so on, according to the method known as continuous lixiviation, as adopted in soda-ash making. The effusion of cold water is continued on the oxalate until the liquor flowing from the vessel shall mark a specific gravity of 1·030: there will then remain in the tank, in almost a state of purity, the oxalate of soda contained in the crude oxalate, and which oxalate may afterwards be converted into binoxalate of soda, or used for the manufacture of oxalic acid.

To JAMES HIGGIN, *of Manchester, for improvements in treating certain vegetable dye-stuffs or preparations therefrom, so as to obtain a coloring substance of increased purity.*—[Dated 28th November, 1856.]

MADDER, and plants of the same species, and most preparations therefrom, contain, in addition to the coloring matter, certain substances, such as pectine, pectic acid, resins, &c., which do not act as true coloring matters, but become attached to the mordants during the process of dyeing, and also form combinations with coloring matter, which fix to some extent on the white or unmordanted parts, and consequently require further operations to give lively and pure colors and good whites. "I act," says the patentee, "on the dye-stuffs, so as to prevent the pernicious effects of the above-named injurious substances, by either removing them wholly or in part by substances capable of dissolving them, or by forming compounds with them insoluble in water to prevent their action during dyeing. Now although my processes are successful when operating on madder or munjeet, especially when fermented or steeped, it is better to act on those preparations which have been treated with acids, such as garancine, garanceux, or extracts from them, and it is to this class of preparations that I most particularly refer. I take garancine or garanceux, made by the well-known process of boiling or steaming madder with an acid, and wash it thoroughly with water. It is a common practice, in order to save time, to neutralize the last portions of acid remaining in the garancine by a wash containing a small quantity of an alkaline or basic substance, giving sometimes a slight excess of alkali, so as to ensure the neutralizing of the acid; but I prefer to wash with water only till the acid is washed out. I then put the garancine into a vessel, which can be heated in any convenient manner, and add sufficient water to make it tolerably fluid. I then introduce the substance which I wish to combine with the impurities in the garancine, and heat the mixture to as high a temperature and for as long a time as may be found necessary for the particular sample of madder in operation: generally a temperature at or near the boiling point of water, and of about two hours' duration, is found to produce a good result; but owing to varieties in the constitution of different madders these details will vary,—a less heat and a shorter time answering better for some madders than others. The proportion of purifying agent will also vary for the same

reasons. When the operation is considered complete, the mixture is allowed to cool, then transferred to a filter, and washed with water till the soluble impurities are sufficiently washed away. The purified garancine is then in a fit state to use in dyeing, or may be pressed, dried, and ground to fine powder.

The substances I use to purify garancine or preparations of madder, as above, are alkalies, alkaline earths, or such combinations of these bodies with acids as will, when boiled along with pectic acid, combine therewith, forming either compounds soluble or insoluble in water,—observing that those substances which combine with the pectic acid are generally found to combine also with the colored substances not true coloring matters, such as resin, &c. It is advisable, however, not to make use of those salts of alkalies or alkaline earths which easily yield oxygen, or which are generally termed "oxydizers." Some organic substances, not salts, are likewise available for the above purpose, such as mucilage, glue, sugar, and generally any substance which, when boiled, or heated with pectic acid, combines therewith, is applicable to purifying preparations of madder, as above described.

In order, however, that my invention may be more clearly understood, I will describe the method I use for Turkey madder of the finest quality. After making it into garancine in the ordinary manner with sulphuric acid, and carefully washing out the acid used in the manufacture, I put in a vat a quantity which represents 5 cwt. of madder; I add about two hundred gallons of water and a solution of arsenite of soda, made by boiling seventeen pounds of crystallized carbonate of soda dissolved in water, with excess of arsenious acid, for half an hour,—filtering out the undissolved arsenious acid and using the clear liquor only: I then heat the mixture to the boiling point, or nearly so, for an hour: when cool, I put it in a filter and wash it with two hundred gallons of water, or till the arsenite liquid is all washed out. The garancine is then ready for use, or for drying and grinding. Many salts may be used instead of arsenite, though this gives very good results; and for some purposes, a very short duration of time of the treatment with heated mixtures or solutions is necessary; and although a better effect is produced by filtering the purified garancine, and washing it with water, yet a certain improvement may be effected by treating garancine or preparations of madder with a purifying agent, at a temperature above the natural temperature of water, for a time sufficient to form combinations with pectic acid, &c., and then cooling down to the ordinary temperatures at which dyeing operations are usually commenced, and dyeing goods at once without previous filtering and washing.

When garanceux is operated upon, it is advisable to take only about half the quantity of the purifying agent which is given to garancine—all other circumstances being alike; and when extracts of madder or garancine containing pectic acid or resins (but freed from vegetable fibre) are operated upon, a much less quantity of water will suffice."

The patentee claims, "the use of alkalies, alkaline earths, salts of alkalies or alkaline earths, or other substances capable of combining with the pectic acid, resinous or other impurities of madder, or preparations therefrom, at temperatures above the natural temperature of water, for the purpose of removing or rendering innocuous those impurities."

To Charles Carey, *of Bessborough-street, Pimlico, for improvements in the vessels and filters used for making infusions of coffee and other substances.*—[Dated 17th July, 1856.]

This invention consists in arranging vessels and filters for making infusions of coffee and other substances, in the manner shewn in Plate V. The pot which is shewn in section is made of porcelain or other suitable material; its shape may be varied, but it is preferred that the interior should be cylindrical, or nearly so. *a, a*, is a frame, suitable for receiving thereon a bag *b*, of muslin or other suitable filtering fabric: this bag *b*, may be readily removed from and placed on the frame *a*, and it is important that such frame should be as open as may be, using as little metal as possible, in order that the bag *b*, may be kept distended thereby, and yet interfere but little with the fluid coming in contact with the whole surface of the interior of the bag. It is important that the bag *b*, may, as nearly as may be, fit the interior of the pot, and descend nearly to the bottom, so as in fact to constitute a lining, leaving as little space below the filter bag *b*, as can conveniently be done;—the object of this apparatus not being as heretofore to filter the water through the coffee or other matter placed in a filter, but to obtain an infusion, as if no filter were present, by allowing as much of the water as possible which is put into the pot remaining in contact with the coffee or other matter in the pot, till the infusion is poured off, or the filter with its frame *b*, is raised out of the pot, and placed on a perforated frame (which fits the top of the pot) in order to drain off the remaining fluid.

In using this apparatus, the filter *b*, being in its place in the pot, a quantity of ground coffee or other matter is to be placed in the pot: the desired quantity of boiling water is then to be poured therein, and the cover *c*, placed on the pot. After allowing the whole to stand for a short time, the extract may be poured out from the spout, without removing the filter, or the filter may be first lifted out of the pot; and, when using large pots, the filter may be placed on a perforated frame, to allow time for the remaining fluid to drain off: in smaller pots this is not found desirable. By this arrangement it will be understood that the objectionable mode of obtaining extracts, heretofore practised, is got rid of, which consists of filtering successive quantities of boiling water through the same quantity of coffee or other matter placed in a filter, and mixing the several extracts below the filter; such objectionable practice having resulted from the use of filters which descend comparatively only a short distance into, and occupy but comparatively a small portion of the interior of the pots with which the filters have been used; whereas, in the present arrangement, the apparatus is made suitable for the whole of the water required, being at once poured into the pot, as above explained; the filter forming a lining to the pot in which the infusion is made, and only acting as a filter when pouring out the extract, or when removing the filter from the pot,—the infusion being made by the water poured into the pot remaining in contact with the coffee or matter therein, in place of passing through the filter into the space below the filter as heretofore.

To PETER APPLETON, *of New Swindon, Wiltshire, for improvements in knives for peeling apples, potatoes, and other fruits and roots.*—[Dated 18th March, 1856.]

THIS invention consists in attaching to the side of the blade of a knife, a guard or plate, the edge of which is parallel with, and projects slightly beyond, the cutting edge of the blade. When the knife is in use, the guard rests on the surface of the fruit or root, and prevents the blade from penetrating to a greater depth than the distance between the cutting edge and the guard, which distance is adjusted according to circumstances. The paring removed passes between the blade and the guard, and then away through a slit or opening in the guard.

In Plate V., fig. 1, shews a side view of a knife with a straight blade, and fig. 2, shews an edge view of a knife with a bent blade. These knives are rendered suitable for peeling apples, potatoes, and other fruits and roots, by reason of a plate or guard *b*, applied to the blade *a*. The patentee remarks, that the mode of attaching or fixing the plate *b*, may be varied from the means shewn without departing from his invention.

To GEORGE SIMPSON, *of Leather-lane, for improvements in rotary knife-cleaning machines.*—[Dated 9th May, 1856.]

THIS invention consists in the application of a spring within the axle of the knife-cleaning machines, and so arranging it as to produce an uniform pressure of the brushes upon the surface of the knife blades.

The figure in Plate V., represents a sectional view of the axle of a rotary knife-cleaning machine, with the improvements applied thereto. The axle is made in two parts, *a*, and *b*; the central portions *c*, *d*, are made square and hollow. In the part *b*, the axle is made hollow throughout, and the square part *d*, made so that it will fit within the part *c*. *e*, *f*, are plates or bosses to which the brushes for cleaning the knives are fixed by screws. The brushes are of the description ordinarily made for rotary knife machines, that is to say, discs of wood, partly filled in with bristles, and partly covered with pieces of buff leather placed edgewise. Beyond the plates *e*, and *f*, are fitted two bosses, which press against, and serve to partly support, the sides of the machine; these bosses are retained in their places, on the one side by a screw cap, and on the other by a collar or milled head. The handle by which the axle and brushes are put in motion is fitted on the square end *g*, and secured by a nut. Within the hollow of the part *c*, is fitted a spiral spring *h*, held at one end by a pin *i*, which passes through the metal of the axle; the other end of the spring is secured to a pin *k*, which passes through the hollow part of the axle *b*. Upon the outer end of the pin *k*, which projects beyond the axle *b*, is cut a male screw, to which is fitted a nut *l*. When the two parts of the axle are put together, the square part *d*, slides within the recess of the part *c*; the nut *l*, is then screwed up: the pressure of the nut against the spindle *b*, causes the spring *h*, to expand, the re-action of which presses the plates *e*, *f*, nearer together. This brings the brushes in closer proximity, and the pressure, when once properly adjusted, is not liable to be relaxed or removed, because the spring is entirely protected from external injury by the parts *c*, *d*, sliding one within the other, and the adjust-

ing screw is concealed by the screw-cap, which secures the boss to the side of the machine. But if at any time the brushes require bringing closer together, it may be done by removing the screw-cap and screwing the nut *l*, a few turns tighter.

The patentee claims, "constructing rotary knife-cleaning machines with a spring or springs fitted and applied thereto, in the manner and for the purpose hereinbefore described and shewn, or any mere modification thereof."

To Oliver Long, *of Cornhill, for improvements in mechanical knife-cleaners.*—[Dated 2nd August, 1856.]

This invention consists, first, in a peculiar combination of apparatus for holding the handles of several knives securely between narrow boards, by means of moveable stops and thumb-screws; and, secondly, the invention consists in combining a suitable holder for knives with a knife-board or boards, on which the knife-blades are to be cleaned, in such manner that the blades of the knives may be laid flat, side by side, and be securely pressed down by mechanical means on the surface of the knife-board, whilst one side of the blades is being cleaned, and then, without taking the knife handles from between the narrow boards or holders, the whole of the knives may be reversed on the surface of the knife-board by one movement (after the holder has been unfastened from the knife-board on which the blades are cleaned), and the reverse sides of their blades cleaned as before.

In Plate V., fig. 1, shews a plan of a knife-board and apparatus combined according to this invention; and fig. 2, is a section of the same. *a, a*, is the knife-board, on which the blades of the knives are placed, and retained securely thereon, when being cleaned by a brush and emery, or other cleaning or polishing material. It is preferred that the surface of the knife-board *a, a*, on which the blades of the knives are held, should be covered with leather. The knife-board *a, a*, is fixed on a board *b*, as shewn. *c*, is a ridge or raised projection on the board *b*, the upper surface of which is covered with leather: the object of this ridge is, that the outer ends of the handles of the knives should rest on the ridge or projection, whilst the blades of the knives rest and are pressed down on the board *a, a*. The knife handles are held securely by moveable stops *d, d*, between the two narrow boards *e, e*; the two narrow boards *e, e*, are secured together, and they are kept parallel by the pieces *f, f*. The several knife-handles introduced between the narrow boards may be securely held by means of the sliding stops *d, d*, and the thumb-screws *g, g*. The sliding-stops *d, d*, are retained in position, and guided by means of a groove in the inner surface of one or both of the narrow boards. In order to move the sliding-pieces or stops *d, d*, so as to fix the handles of the knives placed between them, screws *g, g*, are used, which pass through female screws in the end pieces *f, f*; and each of the thumb-screws *g, g*, is attached to one of the moveable stops *d, d*, so as to move it to and fro. The apparatus shewn is arranged for receiving the handles of eight knives at the same time, though a less number may be introduced, and securely held by the moveable stops; and the handles, so introduced and held, may be of the same or of different sizes.

It will be evident that apparatus may be made according to this inven-

tion to hold a greater or less number of knives than are capable of being held by the apparatus shewn by the drawing.

A holder, capable of holding the handles of several knives, may be securely fixed to a knife-board in various ways, in order that the several blades of the knives in the holder may be pressed down with considerable mechanical force on the surface of the knife-board, when the several blades are being simultaneously cleaned on one side by a brush or rubber. *h*, h^1, is a clamping screw and apparatus for clamping the holder *e*, *e*, on to the knife-board. The stem h^1, of the clamping screw *h*, is fixed to the board *b*, as shewn at fig. 2. By means of this clamping apparatus, the holder *e*, will not only be securely fixed to the knife-board, but the blades will be mechanically pressed and held down on the surface of the knife-board, whilst the upper surfaces of the blades are being cleaned by brushing or by rubbing with a suitable rubber, aided by emery or other polishing materials; and when one side of each of the blades has been cleaned, then, by one movement of the holder *e*, (after it has been unfastened from the board *a*), the whole of the knives may be reversed, and the holder again held by the screw *h*. Or an excentric, or an inclined plane, forced under the back edge of the holder *e*, and between it and the board *b*, may be substituted; whilst the front edge of the holder *e*, or that next the knife-board *a*, is prevented rising by projections on the edge of the knife-board.

The patentee claims, "the combination of the parts constituting the holder with moveable stops herein described; also the combining a knife-holder with a knife-board, in such manner that the blades of the knives in the holder may be mechanically pressed on to the knife-board."

To William Fuller, *of Jermyn-street, for improvements in ice-pails.*—[Dated 15th April, 1856.]

This invention of "improvements in ice-pails," relates to that description of ice-pail in which ice-creams or water-ices are made, by exposing the cream or liquid of which the ice is to be made to the action of a freezing mixture while the liquid is kept in motion. Hitherto this object has been effected by placing the liquid to be frozen in a conical or cylindrical metal vessel, which, when placed in the pail, is surrounded with the freezing mixture; and rotary motion is communicated thereto by toothed gearing. Scrapers are also fixed inside the metal vessel for stirring the contents, and turning that portion thereof which is frozen at the sides into the middle of the vessel, so that a fresh quantity of liquid may become exposed to the action of the cold.

In the improved ice-pail, which forms the subject of the present invention, the vessel that contains the liquid to be frozen is made in the shape of a bowl with a curved bottom, so that when the bowl is rotated, the liquid will be thrown round the bottom and sides of the bowl in a thin film. The bowl is provided with a central spindle, and is rotated by means of a handle fixed on the upper end of the spindle; it is maintained in a vertical position by means of a cross-bar, which is secured to the sides of the pail, and a cover is placed on over the central spindle. In order to place the cover on the bowl, or remove it therefrom, it has hitherto been necessary to remove the handle of the spindle, and also the cross-piece, which maintains the same in a vertical position, before the co-

ver can be taken off. This is exceedingly inconvenient, and in the improved ice-pail the several parts are constructed in such a manner as to obviate the necessity of removing the handle or cross-bar which supports the central spindle, when the cover is to be removed.

In Plate V., fig. 1, is an edge view, and fig. 2, is a plan view of a divided bridge or cross-piece, which supports the central shaft of the ice-pail. The two parts of this bridge are made to fit round the spindle, and are secured together by a temporary fastening, such as the ring *f*, which is slidden over the joint, as shewn in fig. 2; or the parts may be secured by means of a pin. The handle is merely made to fit on the square end of the spindle. When this mode of constructing the cross support is adopted, the cover of the bowl may be made in the ordinary way, with a central hole through which the spindle is to pass.

Fig. 3, shews a cover for an ice-pail, divided into two parts, which are provided with flanges, and are made to fit one on the other. By being thus divided, the cover may be taken asunder instantaneously, whenever it is required to obtain access to the interior of the bowl.

Fig. 4, is a side elevation of the cover of the bowl of another ice-pail, from which the cover may be removed by means of a slot made therein. When the cover is placed on the bowl, the slot is covered with a small shutter *e*. By means of this slot the cover may be made to pass the central spindle, and then the slot is covered over, either by a piece that is hinged on to the cover for the purpose, as shewn at *e*, or by a removeable piece that will cover over the opening.

Fig. 5, is a plan view of a modification of the plan shewn at fig. 4. The cover *a*, is provided with a slot, to allow the vertical spindle to pass to the central hole of the cover, as in the former case; but instead of having a door hinged to the cover, as in fig. 4, the slot is covered up by means of an additional piece *a**, which, however, can be removed with facility when required.

Fig. 6, is an elevation of an ice-pail with this double cover *a*, *a**, adapted thereto. The central spindle in this instance is rotated by means of bevil gearing, to which a winch handle is adapted. This wheel gearing is not, however, generally adopted, except to very large sizes of ice-pails.

The patentee claims, "First,—the application to the curved bottom bowl of divided or slotted covers, which may be removed from the bowl without disturbing or interfering with the other parts of the apparatus, as above described. Also the use of the divided central support, shewn in fig. 3, which may be taken asunder by merely withdrawing the holding ring or pin, and the cover then removed from the bowl when required."

To CHARLES BURTON, *of Regent-street, for improvements in machinery for washing and cleansing fabrics and clothes.*—[Dated 9th October, 1856.]

THIS improved washing machinery is illustrated in several views in Plate V. Fig. 1, represents a front view of the improved washing machine; fig. 2, is a side view of the same; and fig. 3, is a sectional view of the outer cylinder and the presser.

a, is a cylinder constructed of wood or metal, with a lid opening about

one-fourth of its circumference. The lid or cover forms part of the entire cylinder, and is hung on hinges or any suitable fastening, and can be opened or turned back on a T support. Two or three draw buttons (figs. 4, and 5), expressly constructed for this machine, are represented at *b*, which have the effect of tightening and fastening the lid by the same operation. The spindle *c*, is fixed at a distance from the centre of the cylinder, which has the effect of rising and depressing that end of the machine, so that when the handle *d*, is turned round, the water may dash backwards and forwards, in order to assist in drawing out the dirt from the linen. The spindle *e*, is fastened on to the other end of the cylinder in the true centre, and has a compensation hinge or joint *f*, to allow of the excentric motion; so that whilst the handle and spindle up to *f*, is turned true, the smaller portion behind the hinge has a slight circular motion during one entire revolution of the crank. The inner cylinder or presser is represented at fig. 3, and consists of three discs, with mouldings placed entirely round them, leaving, by preference, small spaces between each moulding, in order to allow the water more freely to pass, during the operation of washing. The discs are perforated, to allow of regulated pressure being applied by means of different sized weights, according as the articles to be washed are heavy or light. The outer cylinder is formed with a moulded or corrugated interior, in a similar manner to the inner cylinder, but without the intermediate spaces. The whole of the large cylinder and the spindles may be supported on a frame of wood, iron, or any suitable material. A tub or receiver, to turn the dirty water into when done with, is shewn at h^1, which may be let off at the plug or tap *i*. *k*, is a hook to hang a pail on. When the cylinder is stationary, a hook or pin is shut into a hole at *l*, to steady it, and the lid of the large cylinder has a strip of india-rubber, leather, or any suitable substance around it to keep it water-tight when closed. A few thin elastic straps of india-rubber web are used round the smaller cylinder, to keep the clothes which are wrapped round the inner cylinder in their places whilst washing.

The washing is conducted in the following manner:—Place on a table a cloth about the size of the circumference of the presser (fig. 3), and a dozen or more pieces of soiled linen, wetted and soaped; wrap them round the presser pretty evenly, and having placed over the whole, rather loosely, three or four elastic rings, to keep the articles together, put the presser into the large cylinder with about a gallon or so of hot water; shut the lid, and close tightly, and having given a few turns to the handle for a minute or two, the whole of the clothes are perfectly washed. When washed, the suds are run off, and clean water run in, in order to rinse the same.

To Edward Jackson Emmons, *of the State of Massachusetts, U.S.A., for a new or improved nursery chair,—being a communication.*—[Dated 1st December, 1856.]

This invention consists of a chair for exercising a child or infant. The figure in Plate V., is a vertical section of the improved chair. *a*, is a frame, and *b*, a seat, platform, or secondary chair, suspended within the frame *a*, and, by means of springs *b**, *b**, so arranged, that while the child is sitting upon the seat *b*, he will be supported by means of it and the said suspension springs, and while his feet rest on a bar *c*, attached to

the chair-frame *a*, he, by pressure of them on the said bar, so as to raise himself, and subsequently by throwing his weight on the seat, may produce vertical motions of the seat and himself, that may be sufficient to exercise and amuse him. There may be attached to the frame *a*, a scale, which, with an index pointer extended from the frame *b*, may serve to indicate the weight of the child.

The patentee claims, "the nursery chair as constructed, with its parts arranged, and operating essentially as described."

To THOMAS BIRD *and* THOMAS ROSE, *both of Manchester, for certain improvements in castors.*—[Dated 18th March, 1856.]

THIS invention consists in making the lower or rolling part of castors in the form of spheres, globes, or balls, of any convenient dimensions, having their upper parts pressing against one or more smaller balls or spheres, the whole being enclosed in suitable standards or frames, either with or without antifriction rollers, pulleys, or balls. The frame of the castor is provided with a screw, in order to lengthen or shorten it, when required to adjust the article of furniture to a proper height, and if the surface of the floor is uneven, to adjust it to the various inequalities, and give it a perfect level, which arrangement will be found peculiarly applicable to pianos and similar articles.

In Plate VI., fig. 1, is a sectional elevation of a large castor, having a propelling edge or rim without antifriction pulleys or rollers; and fig. 2, is a sectional elevation of a castor with antifriction pulleys, shewing another mode of attachment to the article for which it is required.

In fig. 1, the frame of the castor consists of three parts, *a*, *b*, and *c*, united by the external and internal screws *d*, and *e*,—the part *c*, being the keeper. The sphere or roller is shewn at *f*, being a little smaller at one-third of the diameter from the top than the propelling edge *g*, of the frame, to allow freedom of action for moving in any direction. The upper part of the sphere *f*, plays against a smaller sphere *h*, placed within the cup *i*, having a pointed or spherical surface *k*, which is made of glass, steel, or other hard material, which forms a fulcrum at about the centre. The sphere *h*, fits loosely within its cup *i*, so that it may be able to move in any direction, or a fast or loose convex centre may be substituted for it.

In fig. 2, the lower sphere is bounded at the sides by antifriction propelling rollers or pulleys *l*, any convenient number of which may be used; but it must be observed that such antifriction rollers or propelling pulleys have no weight whatever to sustain, the whole weight resting vertically on the bottom sphere and centre point, leaving the propelling edges and propelling balls or pulleys perfectly free from any weight or resistance. When desired, a castor is attached to the article of furniture, having an adjusting screw, either with or without a set nut in the frame of the castor, for raising or lowering the article on which it is fixed, as shewn at fig. 1. This castor, with the screw, is for the purpose of adjusting the article to the exact height required, and fixing it to a perfect level, to suit any inequalities on the surface of the floor.

In this improved castor the large sphere or ball is made of glass, and the small one of ivory, or similar material,—thus making it a double

spherical insulater peculiarly applicable to pianos, harps, or other musical instruments. When force is applied to the article to which the castor is attached, a reaction commences at *m*, which may be considered as the moving power of a lever shewn by the dotted line *n*, having its fulcrum at *o*, about two-thirds of the diameter of the lower ball. The fulcrum *o*, becomes the moving power of a shorter lever, shewn by the dotted line *p*, representing the other third of the diameter of the lower ball; the upper part *p*, then becomes the moving power which acts upon the smaller sphere or globe *h*, causing it to move, oscillate, or rotate in its cup with endless changes of position, and allows the lower sphere to roll in any direction with ease and steadiness: the said spheres being made of glass, iron, brass, wood, or other suitable metal or composition, are admirably adapted for gun carriages, signal posts, turn-tables, safes, sofas, pianos, harps, or any kind of furniture or article requiring to be moved about. Instead of the one smaller ball *h*, in the cup *i*, any desired number may be used; and also, instead of antifriction propelling pulleys, balls or spheres, placed in suitable cups or holders, may be employed. When desired, any of the cups for holding the spheres or balls may be bound by india-rubber *q*, or other material, in order to prevent noise.

The patentees claim, "the construction of castors with one or more spheres or balls placed in a cup and working loosely against one or more points, spheres, or balls, in conjunction with a larger ball, with its propelling rim composed of balls, pulleys, or edges, as herein described, and illustrated in the accompanying sheet of drawings."

To JOSEPH WALTON, *of Styal, near Wilmslow, Cheshire, for improvements in tables.*—[Dated 9th December, 1856.]

THIS invention relates to the construction of a table, which may be used for any ordinary or ornamental purposes, and at the same time be made available as a writing or work table, containing requisites for various occupations.

In Plate VI., fig. 1, is a cross section of the improved table, shewing the situation of the fittings for writing materials, the top of the table being moved outward; and fig. 2, is a section, taken at right angles to fig. 1, shewing the fittings elevated above the level of the table top, and in a situation for use. The top *a*, of the table is made to slide outward, and beneath this is a chamber *b*, in which is placed a framework *c*, fitted with paper racks, drawers, receptacles for writing materials, and other conveniences usually adopted. The frame *c*, and its fittings, are pressed upward by two spiral springs *d*; but when in the position shewn at fig. 1, it is kept down by a spring-bolt *e*, passing through an aperture formed in a metal plate *f*, and the table then appears as if it were an ordinary table. When it is desired to use the writing materials, the top *a*, is drawn outward, and the bolt *e*, being next withdrawn from the plate *f*, the springs *d*, will force the apparatus upward; this they do for a certain distance, and the motion is then continued by pairs of levers *g*, *g*, hinged to centres at *h*, *h*, and drawn together by an india-rubber ring *i*. Upon arrival at the proper elevation, the frame *c*, and its contents, are arrested by stops *k*, *k*, coming in contact with the top *a*, the outward motion of which top is also determined by stops. When it is desired to restore the appearance of the

table, the frame *c*, is pressed downward, whereby the levers *g*, *g*, will be caused to turn downward upon their centres *h*, and the springs *d*, will be collapsed; in which position they will be retained by the spring bolt *e*, passing through the plate *f*, after which the lid *a*, may be pushed backward. Instead of the table being formed with a writing apparatus adapted thereto, the frame *c*, may be constructed with suitable fittings for needlework, for drawing materials, or requisites for other such occupations. The patentee remarks, that instead of using the springs and levers above described, other means, as weights, for instance, concealed in the legs, may be used for the same purpose. The table may also contain ordinary drawers, as at *l*.

The patentee claims, "the adaptation to tables, which may be used for ornamental or useful purposes, of a sliding top, for the purpose of allowing apparatus, as aforesaid, to be elevated and exposed for use."

To Robert Hawthorn *and* William Hawthorn, *both of Newcastle-upon-Tyne, for an improved arrangement of steam pump.*—[Dated 25th February, 1856.]

This invention relates to the arrangement of the vacuum and air vessels of pumps for raising and throwing water or other liquids, in connection with several valves and working gear of the pump; also in the size and arrangement of the piston-rod of the steam cylinder in connection with the pump-plunger, together with the general arrangement and disposition of crank-shaft with its bearings and connecting rod.

The figure in Plate VI., represents a front elevation of a steam-pump, arranged according to this invention. *a*, is a vacuum vessel, cast on or fixed to one side of the pump *c*; and *b*, an air-vessel, cast on, or fixed or jointed to, the other or opposite side. The suction-valve is placed as at *d*, at the bottom of the working barrel of the pump, so as to admit of the vacuum vessel *a*, being brought close to it. The delivery-valve is placed near the bottom of the air vessel *b*, which is also close to the working barrel of the pump, thus rendering the action of the vacuum and air vessels more efficient, as the water has the least possible distance to travel before it is relieved by them of the concussion caused by the descent of the pump-ram, whereby the thumping noise and strain upon the suction and delivery-pipes is avoided. Doors are placed in front of the suction and delivery-valves, to make them easy of access.

The vacuum and air vessels are made in the form of pillars, connected at the top by an entablature *f*, to which an inverted steam cylinder *g*, is bolted directly over the pump *c*; or the cylinder may be fixed to the pillars formed by the air and vacuum vessels, which have also brackets *h*, cast upon them for carrying the frames *i*, *i*, sustaining the pedestals or plummer-blocks for the crank-axle *k*. The piston is bolted to, or cast in one piece with, a large bar or tube *l*, of any form, which acts as both piston-rod and pump-ram; it reduces the effective area of the piston acted upon by the steam on the up-stroke, when the single-acting pump offers no further resistance than that caused by friction, and the partial vacuum due to the height the water has to rise by suction. The weight of the piston and pump-ram assists the pressure of steam on the down-stroke, and, in conjunction with the fly-wheel *m*, renders the action of the pump more

equal than when the surplus pressure of steam on the up stroke (where the ordinary piston-rod is used) is transmitted through the fly-wheel alone. The piston-rod contains a vertical opening *n*, through the centre of which the crank-axle passes: the crank *p*, works by the side of the piston-rod or pump-ram, and the top end of the connecting rod *o*, is connected to the latter by a pin, having a hoop forged upon one end of it, which encircles the rod, and may be secured upon it at any required position, by a set screw or cotter; or the pin may pass through the piston-rod and be fixed by a nut or cotter on the opposite side. The excentric *r*, may either be made separate, or formed on the boss of the fly-wheel.

The patentees claim, "the arrangement of the vacuum and air vessels of pumps for raising and throwing water or other liquids, in connection with the several valves and working gear of the pump; also in the size and arrangement of the piston-rod of the steam cylinder in connection with the pump plunger; together with the general arrangement and disposition of the crank-shaft with its bearings and connecting rod."

To JOHN GREEN, *of Charlotte-street, Portland-place, for an improved cooking apparatus.*—[Dated 17th October, 1856.]

THE improved cooking apparatus consists of a light, strong, semicircular screen of tin or other suitable material with continued flat sides. In the bottom of the screen is an opening covered by a lid perforated with holes, and underneath the screen is a small closet, for the convenience of placing a can or vessel to receive the gravy from the opening at the bottom of the screen during the process of roasting,—the can or vessel being so conveniently placed that the cook can take it at pleasure for charging and recharging (when necessary) the self-acting gravy pan that is placed on the top, or under the top of the screen, which has a regulating screw or slides for controlling the gravy or fat, as may be required. Underneath this self-acting gravy pan it is so arranged as to cause the gravy or fat, or both, to flow on different parts of the meat while roasting.

The top of the screen is fixed, and made on a bevel or incline, and consequently it causes a powerful reflection of heat to the meat during roasting. There is also a gibbet or gallows, made of iron or other metal, which is attached to the screen at the back, and rises therefrom, and extends in a curve over the top of the screen, supporting the bottle-jack and a chain: this chain passes through a hole at the top of the screen from the bottle-jack for suspending the meat thereto. At the back or side of the screen is placed a door, affording the cook every accommodation that may be required. There are also two or more shelves, which may be placed inside the screen on rests, placed therein for that purpose, and taken out at pleasure; these shelves can be used for baking and other purposes during the process of roasting.

This invention also includes a square tin or iron oven, which can be used separately or in conjunction with the screen; one end being open for the purpose of placing in front of the fire, and the other end fitted with a door or lid. When open, the oven is so arranged as to fit close to the screen, and thereby conduct the whole of the heat from the front of the fire to the meat; there are also shelves, which may be used at pleasure

for baking pastry and other things; there is also a door or opening at the side for regulating the fire.

The invention also combines a new construction of power in the bottle-jack, which power is worked by a spiral or flat spring made of steel or other metal, or a spring composed of india-rubber, placed within a tube or otherwise, for the purpose of giving motion to the movements of the jack.

The patentee says, "what I claim is, the reduction of cost, and simplifying the construction of the screen, as follows:—

"Firstly,—the present apparatus is much lighter and stronger, and at the same time more convenient. Secondly,—the arrangement of a fixed bevil or angle top to the screen with gravy pan thereon, with one screw or slide for the purpose of diffusing the fat or gravy over various parts of the meat while roasting. Thirdly,—the door or opening at the back or sides, for the greater accommodation of observing the progress of roasting. Fourthly, —the improvement of shelves that can be placed or removed at pleasure, and which shelves can be so placed as to concentrate the heat for the more speedy roasting of a small joint, —one shelf having a hole for the chain of the jack, and also an arrangement for the basting pan, which can be removed for the roasting of a large joint. Fifthly,—the arrangement of the shelves for the baking of pastry and other things at the same time as when roasting. Sixthly,—the improvement in the bottle-jack, as hereinbefore described."

To ALEXANDRE MARIE JOSEPH EECKMAN, *of Lille, France, for a mechanical bakery and cookery.*—[Dated 17th November, 1856.]

THE principal object of this invention is the more perfect and economic baking of bread,—the heat necessary for the baking being also used for cooking or baking other kinds of food.

The oven is formed of a sheet-iron casing lined inside with fire-bricks: its novelty consists in several moveable baking floors, which are placed one above the other, and paved with fire-bricks.

In Plate V., fig. 1, is a front view of the inside of the oven; fig. 2, a front view with two of the baking doors removed, to shew the articles in process of baking. *f*, represents loaves of bread, and *g*, a piece of meat. *a*, *a*, are doors of the baking chambers; *b*, *b*, doors of the fire-boxes; *c*, flue for the escape of the smoke. The baking floors are round, and rest on a central vertical shaft *i*, (fig. 1): a handle *m*, is fastened to the top of the shaft for turning the floors round, so as to bring near the doors the articles when they are considered to be cooked, so that they may be replaced by others. The fire is made on each side at *b*, *b*, with any suitable fuel: the flame and hot gases run through suitable flues, and after circulating about the oven they escape in the chimney *c*, as is shewn by the direction of the arrows, and as will be understood by looking at the horizontal sectional views, figs. 3, 4, 5, and 6.

Fig. 3, is a horizontal section made through A, A, fig. 1; fig. 4, is a similar section through B, B; fig. 5, is a section through C, C; and fig. 6, is a section through D, D.

The black arrows shew the direction of the flame from the left fire-box, fig. 1, till it reaches the chimney, as seen at *r*, figs. 1 and 6: the dotted

arrows shew likewise the direction of the flame from the right fire-box, fig. 1, till it reaches the chimney pipe at *s*. A thermometer and a water-pan is placed round the upper chamber, so that warm water may be procurable by opening the cock *k*. The second part of the invention relates to a kneading apparatus, and is composed of a semi-cylindrical box made either of tinned or of galvanized sheet iron or other suitable metal. Fig. 7, is an end view; fig. 8, a separate view of the box A, in its warming pan D; and fig. 9, the kneading blade which mixes the dough. The ends of this kneading box are of a spherical shape. For preventing the cooling of the dough when working it, the kneading box is placed in a tub or pan containing warm water; this pan is placed in a wooden chest, to which the kneading apparatus is fixed. Within the kneading box is an iron blade B, shaped like an S, with hooked fingers *i*, *i*.

The kneader is actuated by turning a handle E, attached to a shaft bearing a pinion *a*, which gears with another larger pinion *b*, and this latter with a wheel *c*, fixed on the shaft of the kneading blade B. In small kneading apparatus the blade B, may be raised, as seen at fig. 7, for removing the dough; whilst in larger ones the dough is taken out by swinging and half turning over the box A, which is the metallic kneading box; F, is a wooden chest; D, warming pan; B, kneading blade; and *a*, *b*, *c*, gearing for driving the apparatus.

The patentee claims, "the application of several moveable baking floors placed one above the other, revolving by the action of a common central vertical shaft, for the purpose of baking bread and other articles of food with the same fire, which oven may also heat apartments. Also the spherical shape of the ends of the kneading box, which allows the dough to be completely kneaded and easily removed; and the application of a warming pan to prevent the dough cooling while working it."

To EBENEZER ROGERS, *of Abercarn, Monmouthshire, and* HERBERT MACKWORTH, *of Clifton, Gloucestershire, for improvements in coking, and in apparatus for that purpose,—being partly a communication.*—[Dated 30th June, 1856.]

THIS invention relates to improvements in the process of coking coal or other suitable material, and also to improvements in apparatus or kilns for that purpose.

In Plate VI., fig. 1, is a plan, and fig. 2, is a transverse section of the improved kiln; *a*, *a*, are the walls of the kiln, which are provided with horizontal flues b^1, b^2, which open into the side or bottom of the mass of coal or other suitable material. Connected with each of these flues is a vertical chimney c^1, c^2: the flues and chimneys need not necessarily be horizontal and vertical, and more than one flue may be connected with the same chimney or stack, but the arrangement first described is preferred.

The dotted lines *d*, *d*, represent a moveable railway by which the coal may be brought into and the coke removed from the kiln. In filling the kiln with coal, care must be taken to preserve passages or flues for the air and gases between the corresponding flues in the opposite walls; this may be effected by building or constructing the passages with the larger pieces of coal, or by means of channels or flues in the bed of the kiln, or by other suitable means: when the coal is of different sizes, it is also advantageous to let the size of the pieces of coal diminish towards the top of the mass.

The surface of the coal when filled in, as shewn at *e*, *e*, is covered with small coal, or it may be covered with ashes or other suitable material. When the kiln is filled, the walls *f*, *f*, are built up, or the openings may be closed by doors, made of iron frames, filled with fire-brick: the kiln is not covered by an arch, but left open at the top. The apertures of the flues b^2, and chimnies c^1, fig. 2, are closed, and the coal is ignited through the flues b^1, b^1: the air then enters the flues b^1, and passes through the coal and then ascends the chimnies c^2, c^2. When the current of air has proceeded in this direction for some hours, the flues and chimnies b^1, and c^2, are closed and b^2, and c^1, are opened, which reverses the direction of the current of air through the mass; this alternation of the current may be repeated as often as is required; at the same time air descends through the upper surface of the mass of coal. When the mass is well ignited, the external apertures of the flues b^1, and b^2, may be closed, and the chimnies c^1, and c^2, opened: the air now enters from the upper surface only and descends through the mass of the coal, and the products of combustion pass up the chimnies. The coking gradually ascends from the bottom of the mass to the top, and can be regulated or equalized by opening or closing, wholly or partially, the apertures of the flues or chimnies. The gases and tarry vapours produced by the distillation or combustion descend through the interstices in the incandescent mass below, and deposit a portion of the carbon contained in them while the remaining gases pass up the chimnies. The coke at the lower part of the kiln is protected in a great degree from the action of the air by being surrounded and enveloped in the gases and vapours which descend through it. The flues b^1, b^2, may enter at the bottom of the kiln or at the side above the bottom: when they enter above the bottom, the space below them may be filled with small coal, which becomes coked by the radiant heat from the incandescent mass. The passages through the mass are constructed upon this bed of small coal with the larger lumps of coal, as hereinbefore mentioned. When the mass of coal has been coked up to the top, it is quenched with water, and the walls *f*, *f*, are taken down and the coke is removed. A portion having been removed, a moveable railway is laid into the kiln so as to facilitate the removal of the remainder. The surface *e*, *e*, of the coal being kept cool by the descending current of air, the workman is enabled to walk over it during the operation. He inserts an iron bar from time to time at different parts of the surface: the bar is easily pushed down until it reaches the mass of coke, which prevents its further descent. In this way the workman gauges the depth at which the coking process is taking place, and if he finds it to have progressed higher at one part than at another, he closes the chimnies communicating with that part, and thus retards the process at that part. This gauging of the surface may be carried on until the coking process has arrived within a very short distance of the surface. In lieu of connecting a chimney with each transverse flue, flues may be constructed longitudinally in the wall, so as to connect two or more of such transverse flues (which are then regulated by dampers), and to convey the gaseous products from them into chimnies of any convenient height; or the gaseous products may be collected, and tar and ammonia and other chemical compounds may be manufactured therefrom by the usual mode. The kilns may be advantageously made from five feet to twenty feet, and even more, in width, and from twenty feet to one hundred feet in length, more or less, as may be found convenient. Very large

quantities of coal can thus be coked at the same time. The coking or charring of peat and wood may be effected in a similar manner to that hereinbefore described with regard to coal.

The patentees claim, "First,—the coking of coal or other suitable material in open kilns, by igniting the mass at the lower part and causing the coking process to ascend gradually from the bottom to the top, while at the same time the air or the gases produced by the combustion or distillation are caused to descend into or through the interstices of the incandescent mass, and thence into flues or chimnies, as hereinbefore described. Second,—the coking of coal or other suitable material in open kilns, by causing currents of air or gas to pass alternately from side to side of the mass and through the same, in manner hereinbefore described. Third,—the constructing open kilns or apparatus for coking with flues and chimnies arranged in manner hereinbefore described."

To BENNETT JOHNS HEYWOOD, *of Hawley-road, Camden-town, for improvements in valves for inflating air-tight bags, cushions, and other similar articles, and for drawing off liquids.*—[Dated 15th October, 1856.]

THIS invention consists in arranging valves for inflating bags, cushions, and other similar articles, and for drawing off liquids in the following manner:—Into the mouth of the bag or other article a socket is fitted, having a screw on its interior. In the centre of the bottom of this socket is a hole, and round the hole a conical enlargement which fits into a similar depression in the plug which screws into the socket, and round this conical depression in the plug a series of holes are bored in an inclined direction so as to lead into a single hole in the top of the plug. When it is wished to inflate the bag, the plug is turned round so as to raise it from the cone at the bottom of the socket, and air is (by the mouth or otherwise) forced into the hole at the top of the plug; and to close the communication with the bag, the plug is screwed down on to the cone in the socket. The valve is in a similar manner applied for drawing off liquids.

In Plate VI., fig. 1, is a vertical section of a valve constructed according to this invention, and arranged for inflating an air-tight bag, cushion, or other similar article. *a, a,* is part of the fabric of the bag, into the mouth of which the socket *b*, is fixed, by means of the nut *c*, screwing on to the stem of the socket, and nipping the fabric between its upper side and the under side of the socket. Up through the stem of the socket is a hole or passage b^1, surrounded at its upper end, where it enters the socket, by a conical enlargement. *d*, is a plug which screws into the socket *b*: it has on its under side a conical indentation corresponding with the enlargement in the socket, and when the plug is screwed down, these parts are brought together, and an air-tight joint is made; but when this is partially unscrewed, air can be blown into the bag, cushion, or other article,—the mouth being applied to the upper part of the plug, and the air passes through the passage d^1, in the centre of the plug; and then, by the inclined holes d^2, into the socket *b*, whence it passes into the bag, cushion, or other article, by the passage b^1. This valve may be adapted for stopping a baby's sucking bottle. By partially unscrewing the plug a passage

is opened, by which air can enter the bottle, and this enables the infant to draw the liquid out of the bottle by sucking at the nipple. The valve may also be adapted to the vent-peg of a beer cask. It may also be attached by cement to the mouth of a bottle, for containing beverages, which can be extracted from the bottle by sucking at the end of the plug when it is partially unscrewed.

Fig. 2, shews a section of a valve adapted for closing the end of a hollow walking stick, which may then be used for carrying liquids for refreshment while walking. The liquid is extracted by sucking the end of the stick when partially unscrewed. This arrangement will easily be understood by reference to the figure without any detailed description.

To John Cowdery Martin, *of Putney, for an improvement in glazing paper.*—[Dated 21st October, 1856.]

This invention relates to the employment of endless glazing surfaces for the purpose of glazing paper continuously in any length. This is effected by adding on the exterior of ordinary rolls used in glazing paper, one or more continuous surfaces or endless coverings (one within the other, when more than one is used), of larger diameter than the rollers; these surfaces being composed of metal or other suitable material capable of imparting a glaze to paper, and so as to form continuous endless glazing surfaces, by the revolution of an upper and lower roller or rollers, and the motion against each other of the loose endless coverings or surfaces between which the paper is to be passed.

In Plate VI., fig. 1, represents a side elevation of an ordinary pair of glazing rolls, having but one continuous surface or loose endless glazing covering on each, between the surfaces of which coverings the web of paper is to be passed. *a, a,* represent the edges of the coverings or continuous glazing surfaces, which are preferred to be from twice to three times the diameter of the glazing roll; *b, b,* shew the ends of rolls to guide and support the coverings, and which may vary in number and position according to the diameter or size of the covering. In cases where the excess of the diameter of the coverings over the glazing rolls is not great, the guide-rolls *b, b,* would be dispensed with. In cases where guide-rolls are used, they may be conveniently moved against the coverings, as they roll out or enlarge in the process of glazing, by means of screws passing through the blocks on which the guide-rolls work, or by levers *c, c,* or any other convenient means. *d, d,* shew the web of paper passing round and between the coverings or glazing surfaces.

Fig. 2, shews a double pair of rolls, and the manner in which one endless covering works round two glazing rolls. It is preferred that the circumference of the coverings, when enclosing two glazing rolls, should be about four times that of one of them; and should more than two glazing rolls be enclosed in one covering, then the circumference of such covering should be proportionately enlarged. a^1, a^1, shew the endless coverings or glazing surfaces; and the dotted line b^1, b^1, shews the web of paper passing round and between the glazing surfaces. More than one endless covering may be placed round or added to the exterior of a glazing roll, for the purpose of glazing paper, and any number of such coverings that may be found

convenient may be used, between which the paper is to be passed and receive pressure for glazing. The endless coverings or glazing surfaces should be made of copper, and of about one-sixteenth to one-eighth of an inch in thickness.

The patentee claims, "the glazing of paper by means of continuous surfaces as above described."

To EUGÈNE THEODORE NOUALHIER *and* JEAN BAPTISTE PRÉVOST, *both of Paris, for improvements in applying metals over hard, vitrified, or any other surfaces, by galvano-plastic process.*—[Dated 1st January, 1857.]

THIS improved process for coating with metals, is applicable, 1st, to vessels, utensils, or other objects made of hard or of vitrified materials, such as china, earthenware, pottery, crystal, glass, or other substances of that kind; 2ndly, to objects of or covered with soft or supple substances, such as leather, caoutchouc, gutta-percha, or other organic substances.

The process for coating vitrified or enamelled surfaces is as follows:—Suppose the object to be treated by the process to be a china vessel, cover first that part of it which is intended to receive the coating of metal with a layer of varnish, or gold size; and when the layer of varnish has become sufficiently dry, apply copper leaf to it, so as to cover it well, and leave the whole to dry completely: carefully remove all dust from the surface, and place the vessel so prepared in a bath containing a solution of sulphate of copper. By submitting now the vessel so prepared to the action of a galvanic battery, as usual a deposit of copper takes place; and when the deposit has acquired a sufficient thickness (for which purpose about 60 hours immersion will be necessary) the vessel is taken out of the bath, cleaned, and smoothed by filing off the asperities, and finished with pumice-stone, to be finally polished as required.

The coppering may also be effected by another process, which is considered to be as efficacious, and more convenient and easy, than that just described. It consists in making use of German gold dust or bronze powder containing much mercury: this metallic powder is a very good conductor. It is to be triturated with common salt: when well mixed, it is put into an earthen basin, and hot water is poured over the mixture; the salt then dissolves, and the copper dust is left to settle. The deposit thus formed is collected, dried, and used as a conductor for the metallic coating to be given to the vessel.

By a similar process the silvering of looking glasses can be preserved from the effects of dampness,—the glass being thus rendered at the same time less liable to break. It is done as follows:—Melt together equal quantities of bees'-wax and tallow: when the mixture has become completely fluid and quite homogeneous, the glass is dipped into it and taken out immediately: it is then allowed to cool, and the parts which are required to be coppered are prepared with metallic powder, and treated in the same manner as before mentioned.

For metallizing objects the surfaces of which are soft, such as animal bodies, the following process is adopted:—First stop all the apertures with modellers' wax, or some other convenient material, and place the dead animal body, which may be a human corpse, in a suitable attitude, and spread over the skin, which is of a greasy nature, a layer of suitable me-

tallic salt; pulverized nitrate of silver being used by preference. This salt then penetrates into the pores of the skin, and when a sufficient quantity of nitrate of silver has been thus applied to the body in question, by means of a brush or otherwise, it is then put into a bath of sulphate of copper, and the galvanic current being established, the whole surface soon becomes covered with a metallic deposit of copper of the requisite thickness; the result being a metallic mummy.

Similar objects, either of china or earthenware, may be covered with iron instead of copper by preparing them as above described and plunging the said objects in a bath containing a solution of protosulphate of iron. The objects which have been thus coated with copper may receive afterwards another coating of either silver, gold, or platinum.

To RICHARD ARCHIBALD BROOMAN, *of Fleet-street, for improvements in the manufacture of cranked axles and shafts,—being a communication.*—[Dated 6th November, 1856.]

THIS invention consists in a method of manufacturing cranked axles and shafts in which the iron is neither twisted nor cut. The iron is prepared in suitable bundles or faggots, and additional pieces are welded on to form each crank, and the cranks are shaped or stamped out by means of stamps or plungers, worked by a forge or steam-hammer, and driven down into counter moulds or matrices. The bars to compose the shafts may be either all arranged longitudinally, or alternately longitudinally and transversely, and after having been welded together are reheated, and hammered or rolled into a cylindrical shape in such manner as to leave bulging or projecting parts which are scarfed or thinned; and on these parts are laid additional pieces or masses of iron to form the crank. The whole is then heated, welded, and united together, and the cranks are formed by the stamps and moulds above mentioned.

In Plate VI., fig. 1, represents a bundle of bars (all of which are arranged longitudinally) ready to be heated and welded; fig. 2, represents the same after it has been welded, or welded and rolled, and shews also the projecting piece which has been left on and shaped to the form shewn at *c*, in fig. 3, which is an end view of the shaft in course of formation,—the rounded or cylindrical portion being shewn in section. The dotted lines on the projecting piece in fig. 2, are intended to indicate the directions of the fibres of the iron. *d*, (fig. 3), is a piece of iron which is subsequently welded upon the part *c*, to form the crank.

Fig. 4, represents a plan or face view of the stamp which is attached to the hammer, and the form of which corresponds to that intended to be given to the crank and to the axles near to the crank; or a number of such stamps may be successively employed in forming a crank, and formed so that each successive stamp approaches more and more nearly to the form to be ultimately given to the crank, in order that the forging may be gradually brought to its finished form. In every case the anvil has fitted into it a die, mould, or matrix, of the same form as the stamp employed in the hammer, or nearly so.

Fig. 5, is a vertical section taken through the centre of one of these dies or matrices, shewing also a part of the stamp above it. *h*, (figs. 4, and 5), represents that portion of the stamp and die or matrix which shapes the

space into which the connecting rod passes. Fig. 6, represents the axle finished. To the cylindrical part *g*, of the crank, the connecting rod is connected. *e*, *e*, are the exterior parts of the crank; and *f*, *f*, the parts of the axle formed by the stamps and dies.

If it is desired to obtain a cranked axle or shaft still better than the one the manufacture of which has been above described, the bars may be arranged in the bundle as represented in fig. 7, in which the bars *a*, *a*, are laid longitudinally, and the bars *b*, *b*, transversely.

The addition of a second piece of metal to form the crank is not essential, as the necessary projection may be obtained by so working the welded bundle beneath a hammer that that portion of the mass which has to be removed to admit the connecting rod between the crank arms shall be beaten out to form or to assist in forming the crank itself. By these means no portion of the metal would be cut away, and the arrangement of the fibres of that portion which formed the crank would not be seriously injured.

The patentee claims, "First,—the method of manufacturing cranked axles and shafts, by welding an additional piece upon a projecting portion of an axle or shaft, and subsequently shaping the crank and the parts of the axle adjacent to the crank by means of stamps and dies, as hereinbefore described. Second,—the method of manufacturing cranked axles and shafts from masses of metal which either have or have not additional pieces welded thereto by means of stamps and dies, as hereinbefore described. Third,—the several methods of manufacturing cranked axles and shafts hereinbefore described, and represented in the drawings hereunto annexed."

To Richard Emery, *of King-street, St. James's-square, for improvements in the construction of axles and boxes of carriages for common roads.*—[Dated 14th November, 1856.]

This invention consists in so constructing the axles and axle-boxes of carriages for common roads that the wear on the bearings of such axles and boxes will be uniform, and that the lateral lashing against the back and front of such axle-boxes will be provided for in a better, cheaper, and more simple way than is common in axles and axle-boxes of the present known constructions.

The improvements consist, firstly, in having the front and back bearings parallel with the axis of the axle, or, in other words, parallel with a centre line drawn through the axle bearings, which parallel bearings, although of different diameters, will be always uniform in their wear; the surfaces being equal both in the bushing for the bearing in the axle-box and the bearing part of the axle-arm.

Secondly, in constructing the axle-boxes of any known or suitable metal, and bushing them with a different metal from that which the box is made of.

These bearings may, if of steel, or case-hardened iron, or hard compositions, be screwed or driven into their places, or shrunk in, or be run in, if of the softer compounds or simple metals.

In Plate VI., fig. 1, is a form of axle-box *a*, *a*, made of any suitable metal, cast or wrought, and in two halves, if necessary, or in one casting.

In each end of this axle-box are annular recesses concentric to the axle, in which are placed the bushings *b*, *b*, to receive the lateral wear of the collar or nut *c*, and the collar at the back of the axle-arm *d*. *e*, *e*, the taper part of the axle-arm, around which is an oil chamber; *f*, is the front parallel bearing; and *g*, the back parallel bearing, so that whatever play the axle may have, the diameters being the same, they will wear the same, and always have a permanent bearing.

Fig. 2, is another form, somewhat different from the one shewn in fig. 1.

The patentee claims, "the parallel bearings at both ends of the axle-arms; and also the form and arrangement of bushings of either or any of the simple or compound metals, as fully shewn in the drawings, and set forth in this specification."

To Michael Burke, *of Liverpool, for improvements in the construction of anchors.*—[Dated 11th December, 1856.]

This invention relates to the construction of anchors, with a joint or hinge near where the shank joins the crown of the anchor instead of the joint being in the crown thereof, as usually adopted.

The figure in Plate VI., is a side elevation of the improved anchor. *a*, *b*, is the joint or hinge, with a ring or shackle at *b*, attached to the pivot or bolt in the joint, or that part of the shank above or below, as may be desired, for the purpose of fishing, or stowing the anchor on board; *c*, the main shank; and c^1, the portion of the shank joining the crown *d*.

The patentee remarks, that his invention consists mainly in forming the joint or hinge in the shank, as at *a*, *b*, on which position of the same the novelty depends; and by means of such construction of anchors their grip and holding power are increased, the fluke entering the ground in a position, as shewn in the figure, most favorable for the prevention of dragging. He claims, "the peculiar position or situation of the joint or hinge in the shank of anchors, as described."

To Samuel Fox, *of Deepcar, Sheffield, for improvements in heating steel wire and tubes, also ribs and stretchers of umbrellas and parasols, for hardening, and in apparatus for straightening wire and tubes.*—[Dated 19th November, 1856.]

The steel wire and tubes, or the ribs or stretchers of parasols and umbrellas to be heated, are placed in cylinders or tubes of iron, or suitable material, such tubes or cylinders having formed thereon rings or projections. The furnace is formed with a door at each end, and is heated by a fire at one end, the chimney or flue being at the other end. The heat and flame are reverberated on to the bed, which is made with channels from end to end,—on the upper surfaces of which the cylinders or tubes are placed, and they are progressively rolled or moved from the front to the back end, where they are taken out in succession, re-charged, and introduced at the front end of the furnace. In order to straighten heated wires or tubes, a large number is placed in several rings: these rings rest on two rollers, and are caused to revolve thereby, the two rollers being kept in motion by any suitable power and gearing. Opposite the ends of

the wires or tubes (which are in the rings), fixed shields or guards are used to prevent the wires or tubes moving longitudinally. The tubes or wires in the rings are pressed on by rollers carried by a lever frame, the axis of which receives motion from the driving axis or shaft of the machine; and from it, by suitable cog-wheels, motion is communicated to the rollers carried by the lever frame, which is capable of movement along its axis.

In Plate VI., fig. 1, is a longitudinal section of a furnace arranged for heating steel wire and tubes, and ribs and stretchers of umbrellas and parasols, for hardening them. Fig. 2, is a longitudinal section of one of the cylinders or tubes, into which the articles to be hardened are introduced. The cylinders are put into the furnace at the door *a*, at the end nearest the fire, and they rest on the upper edges of the longitudinal channels *b*, and as the cylinders get hot they are rolled along, until at last they are taken out at the door *c*, at the other end of the furnace; and as they are moved along in this way, fresh cylinders are continually introduced into the furnace behind those first put in. When the articles come out of the furnace, the hardening process is completed in the usual way.

Fig. 3, is a side elevation, and fig. 4, a plan, of a machine for straightening wire or tubes arranged according to this invention. *a*, *a*, are rings, into which the wire to be straightened is put, and the bundle so made is heated to a red heat in a furnace. When hot, it is laid on the rollers *b*, *b*, in the position shewn: these rollers are driven from the main shaft *c*, which takes into the two spur-wheels b^1, b^1. *d*, is an axis, which also receives motion from the main axis, being driven by the spur-wheels c^2, and d^1. The axis *d*, has a longitudinal groove cut in it, and into this groove a feather on the interior of the boss of the pinion *e*, enters; so that this pinion is capable of sliding from end to end of the axis *d*, and always turns with it. *f*, is a forked lever which embraces the pinion *e*, and this lever also carries the pinions *g*, and *h*, by which the rollers *i*, are driven. To straighten the wire, the rollers *i*, are pressed down on it by the lever *f*, and by sliding the lever along the axis *d*, the rollers are applied successively to every part of the bundle of wire.

To Henry Turner Sourbuts, *of Hyde, Cheshire, for improvements in taps or valves, part of which are applicable to lubricators for steam-engines and other purposes.*—[Dated 28th November, 1856.]

This invention consists in making the plugs of taps or valves hollow, so that the passage, instead of going directly through the plug, as in ordinary taps or valves, will enter at one part of the plug, pass along it, and leave at another part of it. By this arrangement, the orifices of the passage in the plug, when it is turned to interrupt the passage, have more covering surface than when the passage goes directly through the plug, as in valves or taps of the common construction, which are very liable to leakage, from the scanty covering, margin, and imperfect fitting, arising from the difficulty of grinding the plug truly, so as to fit its limited facing.

In Plate VI., fig. 1, is a longitudinal section of a tap or valve, constructed according to this invention. The plug is supposed to be turned so as to leave the passage open. *a*, is the plug, kept in place in the

casing b, by the gland part c, which is secured by set screws d, to the casing. The improved form of plug may be secured in its place in the ordinary way of making cocks or taps.

Secondly, the invention relates to apparatus for lubricating, and consists in combining arrangements for this purpose, with the improvements in taps or valves described under the first head of this invention. This is accomplished by surrounding a casing, having a plug fitted to it, with a closed vessel or receiver for the oil or lubricating matter, and by making passages in the plug to allow the lubricating matter to enter the receiver, and pass out into the steam cylinder or to the mechanism to be lubricated. In one position of the plug the lubricating matter can be poured into the receiver; in other positions of the plug the passage by which it enters is closed, and other passages are opened between the receiver and the cylinder to allow the steam to enter the receiver, and the lubricating matter to pass from it into the steam cylinder or to mechanism to be lubricated. This part of the invention is shewn in section at fig. 2. b, is the casing, and a, the plug, which is kept in position by the gland c, and set screws d. The casing b, is secured in the globular receiver e, which has provision by which it can be secured to the part which is to receive the lubricating matter. A handle f, is attached to the projecting part of the plug a, and a small funnel g, is screwed or otherwise fixed on the end of it. The matter to be supplied to the receiver is poured into this funnel, and passes down the passage a^1, formed in the centre of the plug, and then out at the side of it, passing through an orifice b^1, in the casing b, into the receiver e. The plug a, is shewn in fig. 2, in that position in which the passage a^1, is open for the entrance of the lubricating matter. There are two more holes in the casing b^2, and b^3, and corresponding holes a^2, and a^3, in the plug a. Only one of the holes or passages in the plug a, need be in communication with the receiver at the same time, and each may be brought in communication by turning the handle f, to the required position. In one position, the steam entering the hollow of the plug will pass through the holes a^2, and b^2, into the upper part of the receiver: in another position, the lubricating matter will pass from the receiver through holes a^3, and b^3, into the hollow of the plug and through the passage b^4.

The patentee's claims are, "Firstly,—taps or valves having their passages arranged substantially in the manner hereinbefore described under the first division of my invention. Secondly,—I claim as my invention apparatus for lubricating, when constructed, substantially, in the manner hereinbefore described under the second division of my invention."

To John Gedge, *of Wellington-street South, Strand, for improvements in gas-meters,—being a communication.*—[Dated 1st December, 1856.]

Hitherto, wet gas-meters have been imperfect in their register, owing to the quick evaporation of the water contained in the meter, and the intermittent supply thereof.

By this invention, the water is always kept to the precise level required, by means of a reservoir (hereafter described) which supplies water in exact proportion to the evaporation of that contained in the meter.

The figure in Plate VI., exhibits a front elevation of a gas-meter, with the invention applied thereto. On the top of the meter is placed an air-tight reservoir *a*, of a conical or other convenient shape, having a pipe *b*, connected thereto, as shewn, which passes through the top of the meter. The lower part of this pipe is fitted with a separate short piece sliding up or down, similar to a telescope joint, by which the height of water permanently required in the meter is regulated; the quantity being adjusted by means of the screw *d*, in the escape-pipe *c*. The pipe *c*, is in the form of a horse-shoe magnet; the water passing in at one end round the bottom, and again rising, escaping at the opening when the screw *d*, is displaced. When the meter is charged with water, it is only necessary to charge the reservoir *a*, also, and screw it in its place: the result will be, that as the water is consumed in the meter, by evaporation or otherwise, that in the reservoir descends by reason of the vacuum thereby produced; preventing the fall of the water below its original or fixed level. The reservoir is calculated to ensure the supply for one year or more, it being constructed of larger or smaller capacity, according to the size of the meter, and according to the time required for its use, without refilling.

The patentee claims, "the combination of parts herein described, having for its object the supplying from a reservoir whatever water may be exhausted by evaporation or other cause, from the meter, so long as any water shall remain in the said reservoir."

To Anthony Lorimier, *of Bedford-square, East Commercial-road, for an improvement in re-working vulcanized india-rubber.*—[Dated 20th October, 1856.]

This invention consists in preparing the waste of vulcanized india-rubber by crushing the same between pressing rollers, then subjecting it to a considerable degree of heat, and whilst so heated causing it to be stirred, by which means the mass is progressively brought into a fluid state. The mass is then allowed to cold, but before becoming cold a solvent of india-rubber is added, by which an india-rubber cement is produced, which may be used for spreading on fabrics and surfaces for the purposes of rendering the same water and air-proof.

The waste rubber is first passed between a pair of strong pressing rollers with smooth surfaces, by which the pieces will be crushed and pressed into a thin sheet of a spongy character, which, on being folded together into several layers, will, on being passed again between the pressing rollers, be reduced into a granular condition. The granulated spongy rubber thus obtained may be moulded into form or pressed into sheets by subjecting the same whilst held compressed (with or without a small quantity of solvent, or the vapour of solvent), in metal moulds, or between plates to heat, for which purpose boiling water, steam, or other heat may be employed. After the moulds or plates and the india-rubber therein have become thoroughly heated, the india-rubber is to be allowed to cool in the moulds or between the plates, when the articles produced will have become set and retain the character of vulcanized india-rubber. The vulcanized india-rubber having been reduced into a granular state, as above explained, may be subjected to a high degree of heat in a suitable vessel. The heating is to be continued till the rubber is rendered plastic or semi-liquid, when the

fire is to be drawn. The mass is to be kept stirred during the process of applying heat, and for some time after the fire has been drawn, in order that all parts may be similarly acted on by the heat. Whilst the mass is still warm a quantity of an ordinary solvent is stirred in to render the same more suitable for being spread on to fabrics for waterproofing purposes. Or the more liquid preparation of the vulcanized india-rubber may be obtained from the granulated spongy product above described, by subjecting it to the action of heat and the vapour of a solvent; in which case so high a temperature will not be required as when reducing the granulated vulcanized india-rubber to a plastic or semi-fluid state by the action of heat alone, as above explained. When heat and the vapour of a solvent are used, a much lower temperature will produce the desired result. For this purpose the granulated spongy vulcanized india-rubber is placed in a suitable vessel, whilst the solvent used is placed in an outer covered or close vessel which surrounds the vessel in which the india-rubber is placed. The heat is applied to the outer vessel, which heats the solvent therein, and also the inner vessel and the vulcanized india-rubber therein. When the whole has become heated, the solvent vapourizes, and the vapours pass into the inner vessel and fill the same, by which the vulcanized india-rubber will become more readily acted on by the heat, and it will take up such a quantity of the solvent as will simply soften it or render the mass liquid to the extent desired; and the same may be drawn off from the inner vessel by a tap at the bottom thereof, which passes out of the outer vessel.

The patentee claims, "the re-working of vulcanized india-rubber, by subjecting the same to the combined action of pressure between rollers, and heat, as herein described."

To ANTHONY LORIMIER, *of Bedford-square, East Commercial-road, for an improvement in preparing the surfaces of printers' inking rollers and other articles when vulcanized india-rubber is used.*—[Dated 1st January, 1857.]

THIS invention has for its object an improvement in preparing the surfaces of printers' inking-rollers and other articles when vulcanized india-rubber is used, and consists in subjecting the surfaces to heat, so as partially to melt the same, and thereby to improve such surfaces.

For manufacturing a printer's roller for distributing ink on a table, the inventor selects a stout and flexible vulcanized india-rubber tube, as soft as may be obtained, and of suitable size and length, and draws it on to the stock of the roller; he then takes a metal rim of such a size as to allow the roller just to pass through it, and heats it to a blood-red heat, and passes the roller steadily through it several times, so as to remove all irregularities in the surface, and also partly to melt it. Lastly, he coats the surface of the roller with dissolved vulcanized india-rubber, prepared by crushing scraps of that material between rollers, and afterwards heating it in contact with the vapour of a solvent, as described in the specification of a former patent granted to the inventor, and dated October 20th, 1856. When the roller is dry it is ready for use.

In order to prepare a roller, to be used to apply ink to the surface of type, it is preferred to mould it from scraps of vulcanized india-rubber, according to the process described in the specification above referred to.

Scraps of vulcanized india-rubber are passed together with a little india-rubber solvent, between crushing rollers, until they are reduced to a granulated state; with this is mixed an equal quantity of dissolved vulcanized india-rubber, prepared in the way already described, and in a semi-fluid state the mixture is submitted to the crushing rollers, and then filled into a metal mould containing the stock or core previously coated with the dissolved india-rubber. When the mould is well filled, the two ends of the mould are screwed up, and the material is subjected to considerable pressure; it is then submitted for about three hours to the temperature of boiling water, either by immersing it in boiling water or otherwise. After the moulded roller comes from the mould, its surface is to be finished by passing it through a heated ring and coating it with dissolved vulcanized india-rubber, in the way already described in reference to rollers made from tubes. Printers' balls or dabbers are also prepared by methods similar to those just described for preparing rollers.

To William Beevers Birkby, *of Upper Rawfold's Card Works, Cleckheaton, near Leeds, for improvements in the manufacture of pointed wire fillets used in the preparation of flax, tow, hemp, and other fibrous substances.*—[Dated 12th December, 1856.]

This invention has for its object improvements in the manufacture of pointed wire fillets used in the preparation of flax, tow, hemp, and other fibrous substances. In place of employing the ordinary filleting or backs for receiving the pointed wire teeth, filleting or backs are prepared by cementing several thicknesses of canvas or strong woven fabric together, the upper surface being formed of leather similarly cemented. The pointed wire teeth are set in the ordinary manner.

The fillet may also have a layer of leather cemented at the back as well as at the front; or a metal plate may be attached to the back thereof, to give additional strength when desired.

The patentee claims, "the making of fillets for pointed wire teeth, of layers of fabrics of flax, tow, hemp, and other fibrous substances cemented or glued together, and combined with a front or upper surface of leather, as described."

To George Sherwin, *of Burslem, for improvements in the manufacture of fire-bricks, tiles, crucibles, and other articles, when fire-clay is used.* [Dated 12th December, 1856.]

This invention has for its object improvements in the manufacture of fire-bricks, tiles, crucibles, and other articles, when fire-clay is used. For these purposes, in place of employing the fire-clay and silicious matters in the ordinary condition, they are first "slipped" separately, and then combined together, and with burned clay and silicious matters.

The fire-clay or marl is first prepared by grinding in the ordinary way, and is then mixed with water to make a slip; such a proportion of water being used, that one pint of the mixture or slip should weigh two pounds; the slip is then passed through a wire sieve, of which the wires are placed at a distance of about the sixteenth of an inch the one from the other.

Another slip is also prepared, by taking flint, sand, quartz, or other silicious matter, either in a crude or calcined state, and grinding it when mixed with water; or it may be ground in a dry state, and afterwards mixed with water, if it is preferred: in either case, the slip prepared should be of the same density as that prepared from the fire-clay. The two slips are now intimately mixed together by agitation, in the proportion of three or four measures of clay slip to one measure of silicious slip, and with the combined slips an additional quantity of fire-clay is mixed; and the fire-clay for this purpose is prepared by grinding and slipping, as already described, and by burning it in a kiln; when thus prepared, it is crushed to a coarse powder, and is mixed with the slips in the proportion of one part of the coarse powder to three parts of dry clay and silica contained in the mixed slips. This mixture having been completely made, it is introduced into a slip kiln, similar to that used by earthenware manufacturers, and the water is there evaporated until the mixture attains a sufficient consistency to be moulded into bricks, tiles, crucibles, or other articles.

The same mixture is also employed for bedding and rendering fire-bricks in furnaces; but when it is to be used for this purpose the drying is not carried quite so far as when it is to be moulded into bricks or other articles.

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 110.)

The following paper, by Mr. John Reid, jun., of Glasgow, was read:—
"*Description of Boucherie's process for the preservation of timber.*"

The process which it is the object of the present paper to describe, forms an important improvement in the mode of preparing timber so as to preserve it from decay. It is the invention of the eminent French chemist, Dr. Boucherie, who has been engaged nearly twenty years in bringing it to perfection, and is one of the most effectual processes for rendering wood that is liable to decay durable.

The tubular structure of trees has long been known; but the fact that there is no lateral or transverse communication between the tubes has been ascertained only recently. This fact has been experimentally demonstrated by injecting a coloring liquid at one end of a log, a particular portion only of the end being exposed to the liquid: it was then found that in any transverse section of the log the wood was always stained in exactly the same part. In this manner the letters of a word have been driven from one end to the other of a piece of timber. This fact forms the basis of the present process, the principle of which consists in forcing into the timber a liquid of a preservative nature, causing it to infiltrate into the fibres of the tree as it would into a series of small parallel tubes.

In the first attempts, the vital energy of the trees was employed to draw in the liquid by means of the circulation of the sap, and the liquid

was thus distributed into every part of the wood, and even into the finest tissues of the leaves. As the circulation of the sap however continues for several days, even after the tree has been felled and stripped of its foliage, another process was subsequently adopted, by which the liquid is forced through the timber by an end pressure in a simple and economical manner. The sap is thereby expelled and oozes out from the end of the timber, which is thus freed from the most active source of decomposition, and at the same time injected with a liquid incapable of decomposition under all ordinary circumstances.

The following is the method which, up to the present time, has been found to be most economical and practicable for carrying out the process on a large scale in the preparation of railway sleepers.

After the tree has been felled, a saw-cut is made across the centre through about nine-tenths of the section of the tree. The tree is then slightly raised at the centre by a lever or wedge, so as to open the saw-cut a little: a piece of string or cord is placed all round the edge of the saw-cut, and on lowering the tree again the cut closes upon the string, which thus forms a water-tight joint in a simple and effectual manner. An auger hole is then bored obliquely into the saw-cut from the outside, into which is driven a hollow wooden plug, to which a flexible tube is fitted. The tube communicates with a raised cistern, placed at a height of from 30 to 40 feet above the timbers that are to be prepared, and containing a solution of sulphate of copper. When the preparations have been completed, the liquid flows through the tube into the saw-cut in the tree, and forces itself along the log in both directions, driving the sap out at each end. As soon as the liquid has reached the ends of the log, the process is finished and the log is ready for use.

If the timber is required of the entire original length, the cross saw-cut at the centre cannot be made, and instead thereof, a cap, consisting of a piece of board, ¾ inch or 1 inch thick, is fixed on the end of the log by screws or clamps, and made, by means of a piece of string or cord, to enclose a space at the end of the tree. As the direction of the grain in the board forming the cap is transverse to that of the tree, the liquid cannot pass through the cap, and the injection proceeds from one end of the log to the other.

In order to ascertain when the process has been continued for a sufficient length of time, so that the sap has been all expelled and replaced by the solution of sulphate of copper, a piece of prussiate of potash is rubbed on the end of the timber while in the damp state, and if the solution has reached the end of the log a deep reddish brown stain is produced, shewing that the timber is thoroughly impregnated with sulphate of copper.

The sap expelled from the timber in the process of impregnation contains at most only 1-1000th part of organic matter in solution, and accordingly no inconvenience is experienced in employing it as a solvent for the sulphate of copper. It is, indeed, preferable to many kinds of spring water, particularly those containing lime, which decompose a considerable proportion of sulphate of copper. Troughs are therefore laid under the ends of the logs to catch the sap and the waste solution, which are conducted to a reservoir to be pumped up to the cistern and mixed with sulphate of copper to the proper strength.

The solution that has been found most effectual for preserving the

timber is composed of 1 part by weight of sulphate of copper, and 100 parts by weight of water. The strength of the mixture is ascertained by a hydrometer, having a properly graduated scale. The specific gravity of water at 60° Fahr. being 1000,—if 1 per cent. of sulphate of copper is added, the specific gravity of the mixture will be 1006 nearly.

The sooner the trees are prepared after being felled, the better, and it is therefore advisable to prepare them as near as possible to the place where they are felled. Trees felled at any time between November and May, may be prepared in May; but those cut down in May, or at any time from May to the end of November, should be prepared within three weeks from the time of being felled.

In the course of the operations carried out in the practical application of this process, the following facts have been ascertained:—

All kinds of wood do not absorb equally, and the absorption of the liquid is more rapid in the sappy parts than in those nearer the heart of the tree.

The quantity of the solution forced into the timber is equal in cubic measure to at least one-half of the cubic dimensions of the timber. When a solution containing about 2½ lbs. of sulphate of copper in every 22 gallons, has been forced through a log, it appears, after allowing for the sulphate carried off by the sap, that every 35 cubic feet of wood have retained from 11 lbs. to 13 lbs. of sulphate of copper.

For a log about 9 feet long, the process of impregnation occupies two days, when the timber is newly felled and the solution is supplied by a head of about 3½ feet. If the wood has been felled three months, three days are required; and if four months, four days are necessary to complete the impregnation.

Of different kinds of trees, those which possess most moisture are most easily penetrated by the solution; and of the same kind, those which have grown in the dampest soils. Hence the least valuable and cheapest kinds of timber are precisely those which give the best results when impregnated with the sulphate of copper.

Mr. Reid exhibited samples of the solution of sulphate of copper used in the process of preparing the timber, containing 1 per cent. of the salt: also a specimen of the cross section of a sleeper.

He stated that the longest trial that had been made was of some railway sleepers in France, a number of which had now been laid on the Northern Railway for a period of 8 years, and continued quite sound and satisfactory.

And in answer to a question as to whether creosote could be injected in the same way, and what was the relative expense of the two processes for preserving timber?—Mr. Reid said that creosote of the quality in general use would not flow in sufficiently by a head-pressure like the solution of sulphate of copper, and machinery was required to do creosoting in the most efficient and economical manner; but as the cost of labour was less, the total expense of the two processes came to about the same. The ordinary 9 feet railway sleepers cost about 1*s*. each, prepared with the sulphate of copper.

The following paper, by Mr. JAMES ROBERTSON, of Ardrossan, was then read:—"*On grooved surface frictional gearing.*"

The object of this paper is to describe a system of frictional gearing recently introduced by the writer, intended chiefly for high speeds; and to give such information regarding its action and driving capabilities as the several applications of it in use will afford.

The grooved surface frictional gearing consists of wheels or pulleys geared together by frictional contact, communicating motion independently of teeth or cogs: the driving surfaces are grooved or serrated annularly, the ridges of one surface entering the grooves or furrows of the other. The extent of contact is thus increased in the direction of the breadth of the rim, and a lateral wedging action is obtained, which augments the effect of the pressure holding the wheels in gear; the necessary amount of which is felt to be so injurious to the bearings of the shafts when the power is communicated by plain driving surfaces.

The grooves are made V shaped, and are found to suit best when formed at an angle of about 50°. The pitch or distance between the grooves is varied according to the velocities of the wheels and the power to be transmitted; the smallest pitch employed is $\frac{1}{8}$ inch, and that required for the very heaviest operations about $\frac{3}{4}$ inch. The ordinary pitch is about $\frac{3}{8}$ inch. The wheels are turned up truly, and the grooves equally pitched and made exactly alike on each face with a turning tool, similarly formed to a common screw-cutting tool; so that on applying the surfaces to each other, a well fitted contact throughout the faces is obtained. In order to increase and sustain the wedging action, the points of the ridges are left blunt, to prevent them from reaching the bottom of the grooves.

Cast iron has as yet been the only material used in the construction of grooved wheels, and its action has been found so satisfactory that there is no necessity for trying any other. The surfaces, after working a short time together, assume a smooth polished appearance, taking a greater hold in proportion to the smoothness they acquire; and when a sufficient breadth for the speed and power to be transmitted gets into contact, there is afterwards no perceptible tendency to wear.

The friction caused by the contact of the grooved surfaces appears to be governed by the same general laws as in the case of plain surfaces: it bears the same proportion to the force by which the surfaces are pressed together, whatever be the amount of that force; it is independent of the extent of surface in contact; and the amount of friction caused by the action of the surfaces in motion is independent of the speed of motion. The only points that have to be attended to, therefore, so far as the power or driving contact is concerned, are the angle of the grooves and the pressure holding them in contact; the extent of surface in contact being determined so as to prevent abrasion and withstand the wearing action. With respect to the law relating to the constancy of the amount of friction, irrespective of the velocity of motion, so far as is yet ascertained, there is no evidence that it does not also apply equally with the two other laws: but the friction of two wheels rolling on each other, so long as there is no slipping action, is more properly the friction of quiescence than that of motion; for though in motion, the points in contact in the line of centres may be regarded as

being momentarily at rest. In the experiments instituted by the French government, conducted by M. Morin, the friction of plain flat cast-iron surfaces, without any lubrication, is given at nearly one-sixth of the pressure holding them in contact; and it is generally understood, that plain-surface pulleys or wheels give nearly the same results. In the case of wrought-iron, the friction is somewhat greater, as shewn by the adhesion of the wheels of locomotive engines on the rails. The general laws of friction do not, however, apply so closely to the action of wheels of all diameters, as to flat surfaces: wheels of large diameter, or more nearly approaching to flat surfaces, shew a decided superiority of action. With grooved surfaces also, the superiority of large wheels to those of small diameter, is very apparent.

In order to obtain a high speed from a driving-belt, without the usual arrangement of counter-shafts and belt-pulleys between the main driving-shaft and the machine to be driven, and without the disadvantage of passing the belt over a small pulley, a small grooved pulley is keyed on the shaft, to which the high velocity is to be communicated, and upon it is placed a loose inflexible ring, of two or three times the diameter of the pulley, grooved internally to fit it, and turned up smoothly on the outside to receive the driving-belt. The belt gives motion to the speed-ring, the inner grooved surface of which communicates a higher speed to the pulley. The speed-ring is held in effective driving contact simply by the tension of the belt. For obtaining increased lateral steadiness at high speeds, a double speed-ring may be used, if required. By these arrangements, a belt may be passed over a speed-ring of 16 inches diameter, and yet communicate the same speed to the shaft as if it were passed over a pulley of only 4 inches diameter.

Clutches may also be arranged, for engaging and disengaging, by means of grooved surfaces.

In applying this system of driving, where a reverse motion is required, a disc, having an outer and an inner rim, is keyed to the main driving-shaft,—the outer rim grooved on the inside, and the inner rim on the outside, with corresponding grooves. The shaft that is to be driven carries a small grooved pulley, the diameter of which is slightly less than the distance between the two grooved rims. The motion of this pulley will be reversed, by moving it slightly nearer to or farther from the main driving-shaft, so as to throw it into gear with the inner or outer rim respectively. This plan will be found of great advantage in screw steamers—allowing the screw propeller to be reversed, while the engines are working continuously in the same direction: the propeller will, of course, be driven at a reduced speed when reversed, but this is of little importance in running backwards.

For comparing the pressure required to hold the grooved surfaces in gear and the power transmitted, various opportunities have occurred in the actual use of the frictional gearing, and arrangements have been made for purposes of experiment. One method of comparing its driving capabilities with those of belts, is directly obtained by the simple speed-ring movement already described for raising high speeds. One of these speed-rings has been working satisfactorily on a large foundry fan for some time; and from the circumstance that the fan was previously driven by a belt of the same size over a plain pulley of the same diameter as the small grooved pulley now used, this case affords a certain

practical means of comparing the efficiency of these two methods of communicating motion. Before the application of the ring, the belt was passed over a pulley 6 feet diameter, keyed on the driving-shaft; and over a pulley, 7½ inches diameter, on the fan spindle: but the continual bending of a large heavy belt over a pulley of so small diameter made it difficult to keep up the proper driving tension, and the belt was speedily cut up. The ring now interposed between the belt and pulley is 13½ inches diameter, and saves the belt from injury by the greater diameter over which it bends. The ring works steadily, and drives the fan at the same speed as when the belt was passed directly over the small pulley; thereby shewing that the grooved metal surface does not strain the bearings more than the ordinary arrangement of driving by belts.

Another method has also been employed for comparing the driving capabilities of the grooved-surface gearing with those of belts, by means of a testing apparatus, having the same pressure on the bearings of the axis as is produced by belts. The testing apparatus is made by gearing together two spur grooved wheels, each 21 inches diameter and 3½ inches broad across the face; the grooves being cut at ⅜ inch pitch, and at the angle of 50°. Motion was communicated to the driving-wheel by a 7-inch belt, over a pulley 30 inches diameter, so disposed that there was no pressure to hold the two wheels in gear but the pull or strain of the belt. A plain friction strap wheel was keyed on to the spindle of the driven wheel, with a strap and break handle attached, so that it could either be retarded or stopped. On applying the break, it either caused the belt to slip or stop the driving engine, without the grooved wheels shewing any tendency to slip.

There is a slight slip or irregularity in the rolling action in the grooved wheels, which does not occur in the action of plain surfaces, arising from the difference of the diameters of the points of the ridges and the bottoms of the grooves; but this slipping is little felt in practice, and when measured, is inconsiderable in amount. In a pair of grooved wheels, 8 feet diameter and 1 foot broad, with 24 grooves working together, there is a slip of only 10 square inches in an entire revolution; whereas in toothed wheels of the same breadth and diameter with cogs at 3 inches pitch, of the ordinary proportions, there is a surface to slip over at each cog of about 24 square inches, or nearly the entire area of one side of the cog; making a total slip of about 16 square feet in every revolution.

Lengthened experience is necessary to ascertain the smallest breadth of face that will be sufficient for transmitting a given amount of power without abrasion or wearing action; and it is therefore preferred at present to make the grooved wheels broader in every position than seems to be absolutely necessary. The general proportions of toothed wheels, as regards both breadth of face and other dimensions, are sufficiently strong for transmitting the same power by grooved surfaces; but the writer is of opinion that less breadth of face and lighter proportions of arms and rims can be used with safety. If the grooved wheels are employed in every position in a factory where wheel gearing is required, no shocks or jolting action can take place; and therefore all the wheels themselves, and also the shafting and supports, may be made much lighter than can be used with ordinary gearing.

One of the principal advantages of these grooved wheels is their smoothness of action: in positions and at speeds when ordinary toothed gearing produces a disagreeable jarring noise, their action is scarcely audible.

Mr. Robertson exhibited a number of specimens of the grooved surface gearing, consisting of spur and bevil-wheels, and wheels for reversing the direction of motion; also speed-rings for raising a high speed without the disadvantage of a very small pulley. He also shewed the testing machine described in the paper, for measuring the pressure required upon the journals of a pair of wheels, in order to obtain a given power of adhesion between the grooved surfaces of the wheels.

Mr. Fairbairn doubted whether there would be any advantage over toothed wheels, in consequence of loss of power from friction; he was inclined to think there would be less friction with toothed wheels, well formed, with the correct epicycloid curve for the teeth, and that there would be greater friction on the bearings with grooved wheels, owing to the amount of pressure required to give the necessary adhesion. He considered the system of toothed gearing had hitherto been found better than straps or other frictional means.

Mr. Scott Russell thought the plan a valuable invention, as well as very ingenious; he was much struck with the steady practical way in which the idea had been prosecuted and worked out step by step. The adoption of wedge-shaped grooves was certainly an improvement over the use of plain surfaces for friction, being attended with the advantage of the wedge in increasing the pressure between the surfaces, without increasing the pressure upon the centres of the wheels: an additional hold was thus gained, from the surfaces of one wedging into the other. His impression was, that if the wheels were of very large size, as for the gearing of a large screw propeller, the bite would hardly be sufficient to withstand the hard thumps of a sea-going screw, and that toothed gearing would still be necessary in such cases: he hoped, however, that experiments on the application of the plan would be persevered in for every kind of gearing on a small scale, as the principle involved was so good that it might prove more generally applicable than was apparent at first sight. The contrivance for obtaining a high speed by means of the intermediate speed-ring, without requiring a small-size belt-pulley, was beautifully carried out, and would be valuable in preventing the wear and friction of a strap working on a small pulley.

The following paper, by Mr. J. Stephen, of Glasgow, was next read:—
"*Description of a steam-boiler with combined internal and external furnaces.*"

There are two modes of firing boilers at present in use; one consisting in firing by means of an external furnace placed under the bottom of the boiler, as in the original waggon boiler, and in some examples of its successor, the cylindrical boiler, sometimes with and sometimes without return flues passing through the water spaces of the boiler; whilst in the other mode the boiler is fired by means of a furnace in an internal flue—the flames and heated gases returning under and along the sides of the boiler, as in the Cornish and other boilers.

In the boiler forming the subject of this paper, both these plans are combined, and the heating and evaporating effect is thereby concentrated, whilst space is economised, and the size and cost of the boiler itself is reduced.

The boiler is of the ordinary cylindrical shape, with flat ends and gusset stays. There are two internal flues, with grates at their front ends. These flues unite in a central single combustion chamber at the back of the fire-bridges, and again diverge behind the chamber. They may, however, instead of diverging, be continued in one large flue to the end of the boiler; or, if preferred, for greater strength, the two flues may be carried straight through to the end of the boiler before uniting. Two corresponding furnaces are placed under the boiler, being separated either by a brick partition, or, as is preferred, by a pendent water space. The flues of the upper and lower right-hand fires unite at the back end of the boiler, and communicate with a flue returning along that side of the boiler to the front. This flue communicates with a second flue above it, passing back to the back end of the boiler. A similar arrangement of the flues is adopted at the left-hand side of the boiler, and the two upper flues unite at the back, and their contents pass thence to the chimney. The two upper furnaces are fired alternately, as are also the two lower ones, by which means the consumption of the smoke is very thoroughly effected. The upper or internal furnaces are fired from a stage, on a level with the bottom of the internal flues, so that the ash-pits of the upper furnaces can be cleared out upon the stage.

An important practical advantage affecting the durability of the boiler arises from the external shell of the boiler and the casings of the internal flues being heated equally and expanding equally and together, instead of being unequally strained as in ordinary boilers. When an external fire only is used, the bottom of the boiler is much hotter than the flue, if there is an internal flue; whilst, when an internal fire only is used, the flue is much hotter than the outer shell; and the unequal expansion of these parts gives rise to a severe strain tending to tear them asunder every time steam is raised.

The differences of temperature which must exist in this way between the internal flue and the outer shell of an ordinary boiler will cause a palpable difference in the length of these parts, in the case of a boiler of moderate length, such as 35 feet.

With the new arrangement of steam-boiler which has been described, is also combined a self-acting boiler feed apparatus, consisting of pumps worked by a pair of small donkey-engines. The steam-valve of these engines is opened on the descent of a float within the boiler, when the water-level gets low,—the float acting on the valve by means of a rod passing through the stuffing-box in the boiler shell. The two steam-pistons are connected to cranks at right angles to each other upon a shaft carrying a small fly-wheel, so that the engines can start at any time, in whatever position they may have stopped when last working.

In fitting up the improved boilers, it is usual to arrange in connection with them a self-acting damper adjuster, which was introduced some years ago by Mr. Auld, one of the inventors of the present boiler, and has been long in extensive and successful operation. In this apparatus, the steam from the boilers is made to act upon a column of water, which supports a float connected with the chimney-damper. When the

steam-pressure exceeds a determined amount, it passes through a loaded valve, and causes the column of water to raise the float and close the damper: this reduces the furnace action and brings down the steam within proper limits. On the steam-pressure getting too low, the reverse action takes place. In adapting this apparatus to the improved boilers, it is made to act not only on the dampers, but also on air-valves, which admit air through passages running along the sides of the external furnaces, the air being delivered into the flues at the furnace bridges. The flues of the four furnaces being combined in the manner described, and the furnaces being fired alternately or in rotation, the supply of air may be uniform, or varied only in so far as the chimney draught itself causes it to vary with a uniform aperture. The object of the above arrangement however, is to reduce the air supply when the damper is partially closed and the furnace action restrained, and to increase it, on the contrary, when the damper is opened and combustion goes on more rapidly, at which time more air is obviously required.

Mr. Stephen explained that his object had been to erect a boiler that would do twice as much work as an ordinary boiler in supplying steam, without occupying more space, and, at the same time, with an economical consumption of fuel. There were now two of the boilers at work, of 7 feet and 8 feet diameter, which had been found very satisfactory in raising steam; but there had been no means at present of working them separately, so as to ascertain the exact consumption of fuel in either case.

The following paper, by Mr. MICHAEL SCOTT, of London, was next read:—"*Description of an improved ladder for dredging machines.*"

In the course of operations undertaken with the view of improving the harbour of Blyth, in the county of Northumberland, it became necessary to remove from the bed of the river some very obdurate material, consisting of boulder gravel, rotten rock, and very tenacious clay, with boulder stones in it. A breakwater is in progress, but it is not sufficiently advanced to afford protection from the swell of the German ocean; and during spring tides there is a very rapid stream in the channel of the river.

As it was considered that the above material could be removed only by dredging, a single machine was procured, the ladder of which was formed of timber, strongly put together, and trussed with tension rods underneath. Very soon after this machine was set to work, the ladder got strained, and ultimately gave way, at the distance of about one-third the length from the lower end. It was carefully repaired, new timbers put in, and plates of iron added on each side, the whole being strongly bolted together; but in vain, for it broke a second time. As it was now evident that a new ladder must be provided, the first step to be taken was to make enquiry as to the construction and strength of ladders employed elsewhere; and attention was naturally first directed to the Clyde, where dredging operations of great extent have been carried on; but the writer was informed, that both there and elsewhere, the ladders were formed of timber, some being plated with iron. Feeling convinced,

however, that this mode of construction would not bear the strains to which the Blyth machine was exposed, he devised the arrangement forming the subject of this paper, which has proved quite successful.

In investigating the causes of the breakage of the original ladder, it appeared to arise chiefly from lateral weakness; for when the machine was at work, and the lower end of the ladder, in the bottom of the trench formed by the working of the machine, was pressing the buckets against the face of the bank, if, whilst in this position, a beam swell came against the vessel, so as to move her sideways, then the ladder broke at that part where it came in contact with the bottom of the side of the well in the dredger. It therefore became a primary condition that the new ladder should possess great lateral strength. The other leading conditions were obviously—that the ladder should have vertical strength sufficient to carry the chain of buckets with their load;—that it should be sufficiently rigid;—that it should be capable of resisting compression in the direction of its length;—that there should be a free passage for stones, &c., falling out of the buckets when over full;—that the ladder should be durable under the influence of sea-water;—and, lastly, that it should not be over heavy, so as injuriously to effect the displacement of the vessel.

In attempting to fulfil these conditions, several arrangements of material suggested themselves. If the body of the ladder were formed wholly of timber, it appeared difficult to obtain the necessary strength combined with a free exit for the stones, &c. Again, if the ladder were made in the form of a wrought-iron girder, and of thick plate, it would be too heavy: if of thin plate, there would be danger of the upper flange buckling; and if with a cellular top, then the cells would be too small to admit of painting the interior, and the ladder would suffer from oxidation.

For these reasons, the writer decided upon adopting the following construction.

The ladder consists first of a tubular wrought-iron girder, composed throughout of plates ¼ inch thick, rivetted together with suitable angle irons and covering pieces. The spaces formed by the projection of the upper and lower flanges are occupied by two beams of timber, secured by bolts both to the webs and flanges. At each end of the ladder are strong wrought-iron straps, rivetted to the plates, and bolted through both plates and timber: these straps or jaws carry the plummer blocks in which the tumblers work; and it should be noticed, that the inner set of these blocks bear against the ends of the timber beams, with which they are kept in contact by cotters acting upon the outer block. Underneath the body of the ladder are wrought-iron struts and tie-rods, forming a truss of the ordinary kind. There are openings in the top and bottom plates of the girder to permit of stones, &c., falling from the buckets, the upper opening being perpendicular over the lower when the ladder is at an average working inclination.

It is submitted, that several advantages are obtained by adopting this form of ladder: —

Firstly, vertical strength: assuming the body of the girder to constitute a sufficient upper flange to resist compression, the sectional area of the iron plates alone being more than three times that of the tie-rods;

and therefore, considering the strength of the ladder to be limited by the tensile strength of the tie-rods, the vertical strength of the ladder calculated from the sectional area of the tie-rods would be nearly five times the greatest weight ever put upon it, which will not exceed 14½ tons distributed load, including the weight of the ladder. For the sectional area of the tie-rods, which form the lower flange, is 7 square inches: the distance between the supports, or the length of the girder, is 56 feet: the depth of the girder, from centre to centre of flanges, is 3½ feet. Hence, taking the tensile breaking weight of wrought-iron bars at 20 tons per square inch, the breaking weight would be 35 tons in the middle of the girder, or 70 tons distributed over the entire length of the ladder.

Secondly, lateral strength: assuming the ladder to be laid on its side, and considering the strength to be limited by the tensile strength of the bottom flange, the lateral strength of the ladder, calculated from the area of the bottom flange, would amount to a breaking weight in the centre of 36 tons. Thus, the sectional area of the iron plates, constituting the bottom flange, is 8½ square inches: the length, as before, 56 feet: the depth, 3 feet. Then, taking the ultimate tensile strength of wrought-iron as before, at 20 tons per square inch, the breaking weight in the middle of the girder would be 36 tons.

Thirdly, the form here adopted affords considerable rigidity and power to resist compression in the direction of its length.

Fourthly, the new ladder is much superior to the old one in the facility which it affords for stones, &c., falling out of the buckets to escape.

Fifthly, it is expected to be durable; for there is no part of the surface exposed to the action of the water which is not readily accessible for painting.

Lastly, this ladder was easily and quickly made, and at a moderate cost.

The new ladder has now been at work for about two months, working most of the time during the night as well as by day: it has been severely tested, and having proved successful, the writer submitted the above description of it to the Institution.

The following paper, by M. Pietro Conti, Commissioner of the Sardinian Government, was next read:—"*On a new construction of iron ships for war purposes.*"

The important experiments made at Liverpool and Woolwich by the most learned and competent authorities, on the resistance of iron plates to shots, having given an unfavorable result, the author feels that the title of this paper must appear somewhat strange. However, as the principle of construction now proposed is essentially different from all those hitherto tried, he hopes that it will not be thought undeserving of consideration and discussion.

The use of iron in the construction of vessels, which is a subject demanding more or less the attention of all maritime nations, is of the greatest importance to the author's country. A destructive insect, un-

fortunately not altogether unknown in England, does most serious injury to the timber and ships lying in the Sardinian docks and arsenals; in consequence of which the time they will remain in good condition, and fit for effective service, is considerably shortened, causing a great expense, and rendering it almost impossible to keep a large fleet, not from the first cost, which the country would willingly undertake, in order to put the navy in the desired state of efficiency, but from the enormous expense necessary to maintain it always in the same condition, when the materials have so short a duration.

It has been proved by the above-named experiments, that iron plates are not only easily pierced by point-blank shot, but that the greater the distance from which the shot is fired and the less its force, the greater is the damage produced by it in the ship's wall, especially in the side first receiving the shot, which is not pierced with a clean opening, but torn out or shattered over a large space, so that it is almost impossible to stop the hole, and there is great danger of the vessel being sunk. Even the floating batteries, strong as they are, cannot resist the heaviest shot; and the construction of a frigate on that system would, from the weight and expense, be out of the question.

But although it would be impossible to construct a large vessel on the plan of the floating batteries, these may still afford some useful hints. The bottom of the ship, which is the most expensive part, and the most subject to humidity, dry rot, &c., can be made, as in them, of iron, up to the depth of penetration of the shot in the water: a large frigate can thus have nearly half the total height constructed of iron in the usual manner. The feasibility of this plan is proved by the success which has attended its adoption in the construction of the floating batteries. For the remaining part of the ship which is exposed to shot, the author's idea is not to endeavour to resist the shot, but to let it pass through, with at least as little injury to the sides of the ship and the persons on board, and as great facility for stopping the hole as in common wooden men-of-war; and he thinks that in the proposed plan, if other peculiar considerations do not interfere, there will be much greater facility for repairing the effects of the shot.

It is evident that if it were possible to have, above the line of penetration of shot, iron frames so constructed and arranged as to be protected from the effect of shot, and at the same time to have the sides of the vessel made of common planks, easily worked, placed, repaired, and fastened to the iron frames, the proposed object would be then attained. Moreover, if in the course of a shot there is a fixed obstacle acting as an inclined plane, it is well known that the shot is diverted to a considerable angle from its original direction. A very striking instance of such an effect, is in the deviation caused in the course of a rifle bullet by the bones of a man's body. A bullet can pierce the skin, and although the angle of incidence made by its direction with the tangent to the rib bones be not very small, the bullet is deviated and travels between the bones and the skin for a considerable distance. The author is personally acquainted with several of these cases.

These considerations have led the author to propose the following mode of construction. The framework of the ship is made of angle-iron in the ordinary manner, below the line of penetration. Above that line

the frames have a prismatic form, their horizontal section being a triangle with its vertex towards the outside plank forming the ship's wall. If a shot strike the frame on the inclined sides it will be diverted from its direction, and the only destroyed parts will be the adjacent planks. The shot passing through the planks will strike the other side of the ship; and to provide against the breakage of the frames on that side, they must present there also the same cause of deviation to the shot. This is effected by adding inverted inside pieces, which are fastened to the frame by cotters. The shot being diverted by the frame first struck cannot strike the inside piece of the opposite frame on its vertex, or in the direction of the centre line of the frame, so as to have its full destructive effect; but if the shot strike the outside frame on the vertex, then it will have its full effect and cause a breakage of the frame. To prevent this result, square sectioned bolts are employed for securing the outside planks to the metal frames, and the heads of these bolts are made in the form of inclined planes, similar to the sides of the frames; the middle of the inclined plane covering exactly the vertex of the frame behind it, which thus can be struck only in the safe parts and is completely protected. These bolts, which serve to secure the outside planks, forming the walls of the ship, are strongly fixed to the metal frames by cotters. If the shot strike the bolt-head on the vertex, the head will most probably be wrenched round, turning on the inner corner which is made re-entering for the purpose, or it will be crushed altogether; but the shot will never strike the vertex of the frame. The head of the bolt is lengthened with the same shape above and below the centre of the bolt, so as to fill up the distance between the adjacent bolts; and thus the bolt-heads protect the entire vertex of the frame.

The bolts are easily replaced if injured, and the damaged planks also; but for the purpose of stopping up a hole very quickly, and, indeed, almost in a few seconds, inside planks are employed, supported against the pressure of the water by the inclined faces of the frames. When a hole has been made by a shot in the side of the vessel, composed of the outside and inside planks, to stop the hole, it is only necessary to remove the broken pieces, and slide down two or three of the pieces above, which stop the large hole; and the seams being then caulked all round, the water is effectually prevented from entering, no matter how irregular was the hole made by the shot. After the action, it is a very simple and inexpensive matter to replace the damaged outside planks. In this manner, the parts which are essential to strength, namely, the frames, are always free from injury, and of very durable material; while the wooden part is composed of distinct pieces, of short length, and without curvature, being, therefore, of little cost, easily fixed, and lasting a greater length of time.

The arrangement of the inverted inside metal pieces not only causes the deviation of the shot coming from the opposite side, but also strengthens the frame between the decks,—being fastened securely to the frame by cotters; and if in an extraordinary case a frame should be broken, they afford the means of quickly repairing the broken part in a strong manner. Two screw-jacks might be placed against the nearest stanchion, one at its foot, and one at its head, converging against the two separated ends of the broken frame, just near the point of rupture;

and by the action of the screw-jacks, the two separated parts of the frame would be brought back into contact; and having removed the broken inside piece, a new one, of the same form, could be connected to the broken frame with cotters, for which some holes should be prepared beforehand, and kept not filled.

With regard to the resistance offered by this plan of construction to the action of a heavy sea, the bottom of the vessel, up to the line of penetration of shot, may be made as strong as possible with keelsons and bulk-heads, &c.: above that line, the general system is that of a series of tubes, of nearly rectangular section, formed by the sides of the ship and the decks. The transverse beams carrying the decks can be strongly rivetted to the frames, into which their ends can enter, so as to make one strong framework; and the several frames are kept at the proper distance apart by the inner and outer planks, and also by longitudinal stringer-plates rivetted to the angle-iron of the beams, and also to the frames. The beams are also supported by stanchions in the ordinary manner, which thus give greater rigidity to the structure.

M. Conti said he had not had an opportunity yet of making any experiments: he had been long giving much consideration to the subject, and now proposed this mode of accomplishing the object.

Mr. Fairbain mentioned that at the Admiralty experiments, made ten or twelve years ago at Woolwich Arsenal, at which he was present, the effect of iron shot was tried, fired against wrought-iron plates from $\frac{3}{4}$ inch to 2 inches thick, point-blank, and at different degrees of obliquity; and the curious fact was ascertained that a 36 lbs. shot, fired at a 100 yards range, with a charge of 5 lbs. of powder, went through a $\frac{3}{4}$ inch plate, leaving a hole quite round; but with a small charge of powder, the same shot tore up the joints of the plates all round, causing extensive damage in a direction that would prove highly injurious to the sides of an iron ship. A plate, 2 inches thick, broke the shot to pieces, and sometimes the plates were also fractured by the concussion. From the effect of spent shot on iron, it was then supposed that more injury would be sustained by an iron than a wood ship, the iron being broken into a great number of pieces, scattering dangerous splinters in every direction. The $4\frac{1}{2}$ inch plates used in the recent gun-boats split the heavy shot all to pieces; but with the great wrought-iron gun, lately made at Liverpool, even that thickness of plate had been split.

The mode of construction proposed by M. Conti, appeared theoretically an ingenious plan for diminishing the injury done to ships by shot, and might lead to some important improvements. He feared that if a shot were to come in contact with one of the bolts, the effect might be to throw the shot obliquely across the deck.

M. Conti remarked that they were always liable to oblique shot over the decks, and a vessel was always kept as far as possible from a position exposed to receiving a broadside.

Scientific Adjudication.

COURT OF QUEEN'S BENCH, GUILDHALL.

July 26th and 27th, 1857.

Before Lord Campbell and a Special Jury.

SEED *v.* HIGGIN AND OTHERS.

This was an action for the alleged infringement by the defendants, Messrs. Higgin & Co., Spindle and Flyer Manufacturers, of Manchester, of a patent granted to the plaintiff, Mr. William Seed, who carries on the like trade at Preston, "for improvements in machinery for preparing, slubbing, and roving cotton and other fibrous substances," and bearing date July 14th, 1846.*

Mr. H. Hill, Q.C., Mr. M. Smith, Q.C., and Mr. Hindmarch, were counsel for the plaintiff; and Mr. Knowles, Q.C., Mr. Grove, Q.C., and Mr. Webster, for the defendants. It appeared that the plaintiff's invention related to an improvement in presser-flyers, and consisted in the application of centrifugal force to the presser-arm or lever (through the end of which the roving passes on its way to the bobbin), in place of employing springs as heretofore; the object being to decrease the pressure of the lever slightly as the diameter of the bobbin increases, and thus to produce a firm and hard bobbin. In his specification he claimed "the application of the law or principle of centrifugal force to the particular or special purpose above set forth;" but in August, 1854, he disclaimed the application of the law or principle of centrifugal force, "excepting only the application of centrifugal force by means of a weight acting upon a presser, so as to cause it to press against a bobbin as described in the specification." This disclaimer appeared to have been entered chiefly in consequence of the discovery of the prior suggestion, by Mr. J. C. Dyer, of the use of centrifugal force for the like purpose, under a patent dated February 27th, 1830; but the distinction between this and the plaintiff's was, that in Dyer's patent the presser-lever swung on the lower end of one of the legs of the flyer; and the weight which, by the revolution of the flyer, produced the centrifugal force, was attached to the presser-lever, and revolved with it in the same plane; whereas, in Seed's arrangement, a wire which formed the fulcrum of the presser-lever, extended up the leg of the flyer, and carried the weight at its upper end. The advantages claimed for this arrangement was increased steadiness, owing to the wire rocking in two bearings or supports, and economy of space, from the weight being within, instead of without the circuit of the flyer. The defendants, it was contended, had infringed

* For report of this specification, see Vol. xxx., p. 310, London Journal of Arts and Sciences.

by carrying the weight up the leg of the flyer, increasing, in fact, the bulk of the plaintiff's supporting wire, and thereby rendering the weight at the upper end thereof (which they did not use) unnecessary. Scientific and other witnesses were called to substantiate this view of the case.

On behalf of the defendants, it was contended that the patent was bad on the ground of centrifugal force having been applied by Dyer, and also by Mr. W. Higgin, who, under a patent, dated July 7th, 1834, applied a weight to the top of the presser: the disclaimer therefore, if it substituted any new claim for that originally contained in the specification, was illegal; but if it merely narrowed the claim to the particular mode described of applying the principle of centrifugal force, viz., with the weight at the top of the flyer, there had been no infringement. It was shewn that so far from the defendants having derived their plan from the plaintiff, they had constructed their flyers according to the specification of their own patent, dated April 2nd, 1845, omitting merely the application of a spring which was connected to the socket of the flyer, and bore against a projection on the upper end of the vertical rod that carried the presser. Witnesses were called to prove the continuous working of Dyer's presser-flyers, shewing thereby that the principle of centrifugal pressure was fully carried out prior to the date of the plaintiff's patent; and scientific evidence was also given to the effect that there was no substantial difference between the flyer made by the defendants and that described in Dyer's specification, which had long since become the property of the public. The learned judge, in the course of the trial, signified his intention of giving counsel leave to move the Court on the points touching the validity and force of the disclaimer; and after the summing up of the defendant's case by Mr. Knowles, and the reply of Mr. Hill, he summed up the whole case as follows:—

SUMMING UP.

Lord Campbell.—Gentlemen of the Jury.—As you have been truly told, there are two questions for your determination, and which I think are entirely for your determination; they are questions of fact, and are entirely for you to determine. If they were questions of law it would be my duty to decide them, but I think they are questions of fact depending upon the evidence, and you are the constitutional judges to give your own opinion.

First, with regard to the novelty, I must say it seems to me—but again I ask you to be guided entirely by your own judgment—that a strong case is made out in favor of the novelty of Seed's invention, because he really seems to have brought about a revolution in this branch of the cotton trade (the making of the bobbin). They began with a soft bobbin, and then they had a great desire to have it pressed; and then there were springs that were applied, but the spring produced inconvenience, particularly from the pressure not being always equal, while the bobbin was increasing in size, for in different divisions of the bobbin there were differences in the density of the cotton. Then the great object was to have a presser that would press equally, so that the whole bobbin as it filled might be, as near as possible, of the same consistency. Then comes in Mr. Seed's

invention, which certainly seems to gain the object very effectually by centrifugal force. Now Mr. Carpmael says, what he considers to be the novelty in Mr. Seed's invention is the application of centrifugal force to a presser in such a manner that the weight may be carried up the leg of the flyer. This is described in Seed's specification, which is now confined to one single application of it—the weight being at the top: because, although he at first claimed the application of this generally, he has disclaimed that, and he now confines his claim to the application of centrifugal force, by means of a weight acting upon the presser so as to cause it to press against the bobbin, as described in the specification; and the description in the specification is exemplified in the model which has been laid before you, and of which you are now complete masters. That seems to have been entirely new to Mr. Seed, but although it might be new to him, if it had been disclosed to the world before, he could not claim the benefit of this patent, but you are to say whether it really was disclosed before.

Now, on the part of the defendants, they rely upon Dyer's and Higgin's patents. With regard to Dyer's there was certainly the application of centrifugal force to this operation, but, as it would seem, in a very different manner, by the weight being below and producing the inconvenience of shaking and occupying a larger space; and it would appear that although some instances have been found in which Dyer's, to a very small degree, has been used, it does not appear by any means to have come into general use; and you will probably consider generally that really Dyer's was a failure. Then as to Higgin, it seems to me (but again I say form your own opinion) that Higgin's does not come so near the plaintiff's as Dyer's does; because although the weight there was at the top, it seems to have been applied in a totally different manner. If you should be of opinion that a person reading Dyer's specification, or Higgin's specification, that an ordinary workman would be lead to construct Seed's mode of roving,—then this patent would be of no avail; but it is for you, as sensible men, to say whether, from what you have heard, and from what has been stated before you, and from what you have seen with your own eyes, a workman reading Dyer's specification, or Higgin's specification, would have constructed the machine which has been constructed by Seed, and which was the subject of his patent, which introduced such a great improvement that it was rapidly adopted, and which is now used almost universally in the county of Lancaster. If you think that that was the case, then there was no novelty, and upon that issue your verdict will be for the defendant. But if you think that this was really new, and that it is useful—its utility I think is not contested—if you think that it was really new, and is substantially different from Dyer's and Higgin's, upon that issue your verdict will be for the plaintiff.

Then, gentlemen, with regard to the infringement, the case seems to me to be more doubtful; but upon that you will form your own opinion. Now, with regard to that, Mr. Carpmael having said that the novelty is the application of centrifugal force to a presser, in such a manner that the weight may be carried up the leg of the flyer,—then he says, that the defendant's substantially does this; that there is the application of centrifugal force to a presser, and in such a manner that the weight is carried up the leg of the flyer. Now you will bear in mind how this is done by the plaintiff; how he carries the weight up the leg of the presser, and how it is above the plane. Then you will likewise bear in mind that he uses two bearings, and thus he prevents the shaking that had been produced by Dyer; and that he likewise has the advantage of not at all increasing the space that is occupied by the flyer, so that there may be a considerably larger number of flyers in the same frame than there would be according to Dyer's process. Then you will consider whether what the defendant has done is really an imitation of the plaintiff's.

Now the defendant has not presented himself before you, but that is not at all conclusive. Although the parties to the cause are now competent witnesses, it is not necessary that they should be called. It is not conclusive against the defendant's case that he does not present himself as a witness before you, but you might have thought it satisfactory to have heard how he came by this,

which seems very much as if it were an imitation: how he came by it; whether it was his own invention; whether he took it from Dyers, or whether he got it from Seed, the plaintiff; but he is not here to tell you that. Now if you think the defendant's invention is materially different from that which the plaintiff has discovered, and which is described by him as the application of centrifugal force, by means of a weight acting upon the presser, so as to cause it to press against the bobbin, as described in the specification—if there is a difference in your opinion, and you have paid attention to all the evidence given—and several of the witnesses said it was more like Dyer's than it was like the plaintiff's (and they think it is different from the plaintiff's); you have heard the arguments of counsel ably urged before you; if, paying attention to the evidence and to those arguments, you think the defendant's is materially different, and is not an imitation of the plaintiff's, why then the defendant will be entitled to your verdict. But, on the other hand, if you think, upon the evidence, that the defendant's is an imitation of and substantially the same as the plaintiff's, then it would be an infringement, and, upon that issue likewise, the plaintiff would be entitled to your verdict.

The Jury retired for a short time to consider their verdict.

The Associate.—Gentlemen, are you agreed on your verdict?

The Foreman.—We are.

The Associate.—Do you find for the plaintiff or the defendants?

The Foreman.—For the plaintiff on both issues.

Lord Campbell.—Both as to the novelty and the infringement?

The Foreman.—Yes, my Lord.

Mr. Hill.—Your Lordship will please to certify for a special jury and the other certificates.

Lord Campbell.—Yes.

Mr. Knowles.—Your Lordship will give me leave to move on the points reserved.

Lord Campbell.—Yes.

PROVISIONAL PROTECTIONS GRANTED.

[*Case in which a Full Specification has been deposited.*]

2023. Jean Jacques Bouvert, and François Isidore Jean Pascal, both of Paris, for improvements in smoke preventing apparatus.—[*Dated July 23rd.*

[*Cases in which a Provisional Specification has been deposited.*]

1328. Collinson Hall, of Knavestock, Essex, and Thomas Charlton, of Brentwood, for improvements in agricultural engines and implements used therewith for ploughing and cultivating the soil.

1418. Thomas Knight, of Upton, Cheshire, for an improved cutter and cultivator of land.—[*Dated May 20th.*]

1442. Bernhard Samuelson, of Braffords House, near Brough, Yorkshire, for improvements in safety apparatus for giving artificial light.—[*Dated May 22nd.*]

1467. Henry William Ford, of Gloucester, for improvements in apparatus for facilitating the draft and locomotion of carriages.—[*Dated May 25th.*]

1522. Peter Armand Le Comte de Fontainemoreau, of Paris, for improvements in the construction of smoke consuming furnaces, applicable to boilers,—being a communication.—[*Dated May 29th.*]

1544. Henry Davis Pochin, and James Woolley, both of Manchester, for improvements in the manufacture of gum from amylaceous substances.—[*Dated June 1st.*]

1600. Henry Clark, of Horncastle, for improvements in the rotary engines. [*Dated June 6th.*]

1622. Frederic Koehler, of Finsbury-place, for improvements in gunpowder.—[*Dated June 10th.*]

1642. Joseph Michell Paule, of Alston, Cumberland, for improved means for ventilating coal and other mines.—[*Dated June 11th.*]

1644. John Elce, and Samuel Hartley,

both of Manchester, for improvements in machinery for preparing moulds for casting iron or other metals.—[*Dated June* 12*th.*]

1676. Charles Bernard Ochin, of Paris, for improved metallic roofing slates.

1680. James Cocker, of Liverpool, for an improved construction of gauge for measuring wire and other articles.

1682. John Fowler, jun., of Cornhill, and William Worby, of Ipswich, for improvements in ploughing or tilling land.

The above bear date June 16*th.*

1694. James Heywood Whitehead, of Southside, Yorkshire, for improvements in pressing cloth.—[*Dated June* 17*th.*]

1706. John Everard Barton, of Kidderminster, for an improvement in winding worsted on to creel bobbins of carpet looms.—[*Dated June* 18*th.*]

1728. Benjamin Richardson, of Wordsley Glass Works, near Stourbridge, for improvements in manufacturing and ornamenting articles of flint glass.

1734. Lambert Cowell, of the Adelphi, for an improved machine for teaching the art of swimming.

The above bear date June 20*th.*

1744. Christopher Dicran Seropyan, of New Haven, U.S.A., for a mode of preparing bank notes, bills of exchange, and other papers, to prevent counterfeiting by photography and its kindred processes.—[*Dated June* 22*nd.*]

1748. William Symons, of Dunster, Somersetshire, for improved means of communication between the passengers and guards of railway trains. [*Dated June* 23*rd.*]

1758. Hamilton Henry Fulton, and Thomas Bodley Etty, both of Great Queen-street, Westminster, for increasing the traction and bearing surface of carriage wheels.

1759. Richard Morcom, of Redruth, Cornwall, for improvements in dressing ores.

1762. Charles Fréderic Vasserot, of Essex-street, for improvements in the permanent way of railways,—being a communication.

1763. Henry Genhart, of Liege, Belgium, for improvements in fire-arms, in rifling the same, and projectiles employed therewith.

1764. George Ireland, of Birmingham, for improvements in raising weights, applicable to stamping or cutting metals and other similar purposes.

The above bear date June 24*th.*

1765. John Juckes, of Dame-street, Islington, for improvements in washing machinery.

1766. Alexander Parkes, of Birmingham, for improvements in coating metals with other metals.

1767. Jabez Church, of Upper Kennington-lane, Vauxhall, for improvements in the manufacture of artificial fuel.

1768. Charles Sanderson, of Sheffield, for improvements in the manufacture of railway bars, girders, and other articles requiring great strength and stiffness to resist pressure, concussion, or strain.

1769. George Henri Marc Muntz, of Handsworth, Staffordshire, for improvements in the manufacture of metal tubes and axles or shafts.

1770. Joseph Exley, and John Ogden, both of Leeds, for improvements in furnaces or fire places for the prevention of smoke.

1771. Ernest Auguste Bourry, of St. Gall, Switzerland, for improvements in apparatus or machinery for working, expressing, and moulding clay and other plastic materials.

1772. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for testing the strength of materials,—being a communication.

1773. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the preparation of surfaces for receiving paintings or printed impressions thereon,—being a communication.

1774. Richard Archibald Brooman, of Fleet-street, for an improved composition or polish for maintaining the brilliancy of varnished or patent leather,—being a communication.

1775. Edouard Besnier de la Pontonerie, of Paris, for improvements in apparatus for consuming smoke.

1776. Charles Grafton Page, of Washington, U.S.A., for improvements in cylindrical door bolts.

1777. John Talbot Pitman, of Gracechurch-street, for improvements in

machinery for making wood screws, —being a communication.

1778. Erneste Auguste Bourry, of St. Gall, Switzerland, for improvements in kilns or ovens for burning or baking bricks, tiles, and other earthen or ceramic matters.

1779. William Green, of Ebury-street, for the letter announcer.

1780. John Loach, of Birmingham, for a metallic air-tight coffin.

1781. Josiah Wright, of Ernest-street, Alfred Wright, of Bayham-place, and Francis Roberts, of Bayham-street, Saint Pancras, for treating the rhubarb plant, to render its fibres applicable to the manufacture of paper, and the juice thereof to the manufacture of wine and spirits.

1782. Elijah James Crocker, of Liverpool, for improvements in the rigging of ships and other vessels,—being a communication.

1783. John Ingham, and Edward Ingham, both of Bradford, and Benjamin Ingham, of Halifax, Yorkshire, for improvements in preparing worsted yarns for dyeing.

1784. Joseph Arthington, and Henry Smith, both of Huddersfield, for improvements for the better illumination of the Davy lamp.

1785. Antonio Pelez, of Southampton-buildings, for a new composition for the manufacture of imitative stones, —being a communication.

1786. Jacob Green, of Onehouse, Stowmarket, Suffolk, for certain improvements applicable to bedsteads and other articles of furniture, for the purpose of excluding therefrom bugs, or other similar insects.

1787. William Palmer, of Brighton, for improvements in watering pots, garden engines, and other apparatus for watering surfaces.

1788. James Lamb Hancock, of Pentonville, for improvements in means or apparatus for washing or cleansing.

1789. William Price Struvé, of Swansea, for improvements in miners' safety-lamps.

1790. William Bough, of Bunhill-row, for improvements in lamps for burning resin and other oils and fluids; also an improvement in Argand gas-burners.

1791. Stephen Bourne, of Leonards-square, Kentish Town, for an improvement in the manufacture of felted fabrics.

1792. Howard Glover, of Lambeth, for an improvement in pump buckets.

The above bear date June 25th.

1793. John Lloyd, of Langefui, Anglesea, for improvements in utilizing and deodorizing sewage matters of dwelling houses and other places, and in apparatus to be used in connection with the same.

1794. Robert Hattersley, of Ardwick, near Manchester, for improvements in machinery for distributing and setting up or composing types.

1796. William Parsons, of Brighton, for improvements in fittings to door-handles and spindles.

1797. Benjamin Nicholls, and Samuel Ledward, both of Manchester, for improvements in mules for spinning.

1798. William Crook, Gilbert Rushton, and Joseph Crowther, all of Blackburn, for improvements in looms.

1799. Francis Watkins, of Victoria Works, Smethwick, for improvements in the manufacture of screw nuts,—being a communication.

1800. Michael Michaelis, and John Clemson, both of Manchester, for improvements in the production of ornamental textile fabrics by printing.

1801. Bennett Johns Heywood, of Leicester-square, for improvements in the manufacture of India-rubber goods.

1802. Stanislas Gaudrion, of Paris, for an improvement in screw-propellers, being a communication.

The above bear date June 26th.

1803. Jonathan Preston, of Pendleton, Lancashire, for improvements in apparatus for regulating the pressure of steam and other fluids.

1804. Joseph Pollard, of Highdown, near Hitchin, for improvements in machinery or apparatus for distributing manure.

1805. Charles Thurber, of Worcester, Massachusetts, U.S.A., for an improved caligraph or writing machine, for writing and similar purposes.

1806. John Green, of Newcastle-upon-Tyne, and William Coppin, jun., of Blyth, Northumberland, for the preservation of timber.

1807. Richard Howland, of London, for improvements in the construction of mangles.

1808. Pierre Eugène Liger, of Rouez, Sarthe, France, for improvements in grinding mills.

1809. Arséne Auguste Olivier, of Paris, for improvements in treating or preparing and winding silk from the cocoon, and in apparatus for the same.

1810. George Swindells, and Jonathan Arnold, both of Bollington, near Macclesfield, for certain improvements in spinning and doubling yarns, and in machinery or apparatus of the kind commonly known as mules and twining jennies.

1811. John Carter, and Brook Hodgson, both of Halifax, for improvements in weaving carpets and other fabrics.

1812. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for grinding the teeth of card cylinders, —being a communication.

1813. James Biggs, of New Oxford-street, for a portable folding perambulator, which is so constructed as to occupy less space than any that has hitherto been invented.

The above bear date June 27th.

1814. Narcisse Laurent, of Paris, for improvements in the process of dressing and manufacturing shammy leather.

1815. Samuel Nye, of Wardour-street, for improvements in mills for grinding coffee, pepper, spices, and other substances.

1817. Juan Pattison, of Moorgate-street, for an improved rotatory pump.

1818. James Lawrence, of Colnbrook, for improvements in apparatus for brewing.

1819. John Forster Meakin, of Baker-street, Portman-square, for improvements in carriages for children, commonly called perambulators, and applicable to carriages for invalids.

1820. Henry Gilbee, of South-street, for improvements in machinery for moulding vermicelli and other paste, —being a communication.

1821. John Lyon Field, of Lambeth, and Charles Humfrey, the younger, of Camberwell, for improvements in the manufacture of candles.

1822. Gustav Adolph Buchholz, of Strasbourg, for improved machinery for hulling and cleaning rice, wheat, and other grain.

1823. William Maltby, of Grove-hill, Camberwell, for improvements in the mode of extracting ammonia and other compounds from gas, gas liquor, sewerage, and other substances.

The above bear date June 29th.

1825. Thomas Hardcastle, of Bradshaw, near Bolton-le-Moors, for a machine for doubling, winding, plaiting, and measuring cotton and other fabrics.

1826. Isidore Charles Cloët, of Ghent, for an improved rice and barley-mill.

1827. William Parsons, of Brighton, for improvements in fastenings for windows and casements, and for other similar purposes.

1828. Joseph Alsop, and Edward Fairburn, both of Mirfield, Yorkshire, for improvements in machinery for the manufacture of bread, biscuits, and cakes.

1829. Andrew Spottiswoode, of James-street, Buckingham Gate, for improvements in machinery for compressing artificial fuel and other substances.

1830. William Pole, of Birdcage-walk, for improved means for supporting telegraph wires,—being a communication.

The above bear date June 30th.

1831. Joseph Nickless, of Coalbrook Dale, for a new or improved railway chair.

1832. Thomas Brewer, of Neithrop, Banbury, Oxfordshire, for improvements in machines for cutting and reducing turnips or other vegetable substances.

1833. Alexander Prince, of Trafalgar-square, for improvements in the construction of irons used by tailors and others for pressing cloth and other materials,—being a communication.

1834. Carl Johann Lawrence Leffler, of Westbourne-terrace, for improved machinery for cutting corks, bungs, and other similar articles,—being a communication.

1835. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved processes for ornamenting metallic surfaces, and for producing surfaces in intaglio or in relief for printing purposes,—being a communication.

1836. George Murray, of Glasgow, for improvements in machinery or apparatus for propelling ships and vessels.

The above bear date July 1st.

1837. Frederic Ludwig Hahn Danchell, of New Oxford-street, and Henry Kimber, of Grove-terrace, Clapham, for improvements in the manufacture of fire and waterproof bricks, plates, crucibles, and other vessels, forms for castings, and similar articles,—being a communication.

1838. Andrew Smith, of Princes-street, for improvements in the construction of life boats and other boats or vessels.

1839. Edouard Beckman Olofson, of Cologne, for improvements in the manufacture of pigments or colors for preserving iron.

1840. Augustus Philibert Malard, of Paris, for certain improvements in filtering water and other liquids.

1841. Marguerite Antoinette Laurent, of Paris, for a new antiseptic composition.

1842. Thomas Moy, of Clifford's Inn, for improvements in the mode of working steam-engines.

1843. William McCraw, of Edinburgh, for improvements in the production of photographic pictures.

1844. Edward Taylor Bellhouse, and William John Dorning, both of Manchester, for improvements in steam-boilers.

1845. Charles Orphin, and Edward Lyons, both of Birmingham, for certain improvements in table and other lamps.

1846. George Davies, of Serle-street, for an improved marine steam-engine governor,—being a communication.

1847. George Cutler, of Manchester, for improvements in mangles.

1848. Tomyns Browne, of Liverpool, for an instrument for ascertaining the true or actual acclivity and declivity of bodies.

1849. William Rowan, of Belfast, for improvements in scutching and heckling flax and other similar vegetable fibres, and in machinery employed therein.

1850. William Rowan, of Belfast, for improvements in steam-boilers and furnace flues.

1851. Charles W. Woodworth, of Liverpool, for improvements applicable to capstans and other like purchases,—being a communication.

1852. Jean Baptiste Meeus, of Arlon, Belgium, for an improved method of multiplying motive power, and transmitting it to a shaft or other mechanism.

The above bear date July 2nd.

1853. Joseph Lockett, of Strangeways, Manchester, and William Watson, of Alexandria, Dumbarton, N.B., for improvements in machinery for engraving or tracing designs on cylindrical or other surfaces for printing calico and other materials.

1854. Matthew Clark, of Alexandria, Dumbartonshire, for improvements in the preparation of cloth for Turkey-red dyeing.

1855. Alexander Angus Croll, of Harold's Wood Lodge, near Romford, for improvements in the treatment of liquors containing combinations of sulphur with ammonia.

1856. Charles Topham, of Hoxton, for an improved apparatus for raising and forcing liquids.

1857. Emanuel Ruegg, of Paris, for an improved calendar inkstand.

1858. John Fordred, of Stoke Newington, for improvements in treating and purifying water.

1859. Henry D. Mears, and William Houlton, jun., of Baltimore, U.S.A., for an improved seal for railway luggage vans and for other purposes.

1860. John Edmund Gardner, of the Strand, for improvements in illuminated clocks, and in the apparatus employed for lighting the same.

1861. William Thomas Hendry, of Upper Thames-street, and Robert Henry Hancock, of Great Percy-street, Pentonville, for improvements in the manufacture of flexible tubes or hose pipes.

1862. John Agar, and William Agar, both of Bury, Lancashire, for improvements in watches, and keys for the same.

1863. Thomas Royds, Thomas Roscow, and James Lord, all of Rochdale, Lancashire, for improvements in lifting heavy bodies under certain circumstances, such as minerals or other substances, from mines, to the surface

of the earth, or from one story of an edifice to another, and in machinery or apparatus to be used for such purposes.

The above bear date July 3rd.

1864. Robert Gibson, Joseph Gascoigne, and Samuel Gibson, all of Hunslet, Yorkshire, for improvements in boilers for generating steam.

1865. Michael Henry, of Fleet-street, for improvements in machinery or apparatus for cutting vegetable substances,—being a communication.

1866. Michael Henry, of Fleet-street, for an improved machine for cleaning and crushing grain,—being a communication.

1867. George Cooper, of Sheffield, for improvements in safety-lamps.

1868. John Grantham, & Henry Sharp, both of Liverpool, for improvements in working the valves of steam-engines.

1869. Joseph Mills, of Leicester, for an improved method of covering ricks, booths, tents, and such like places.

The above bear date July 4th.

1871. Thomas Bowden, of Pendleton, Lancashire, for improvements in apparatus for discharging the water resulting from the condensing of steam used in apparatus heated by steam.

1872. William Munt, of Charter-house-lane, Smithfield, for a shank, to be attached to all descriptions of buttons, to be called an eylot shank.

1873. Frank Clarke Hills, of Deptford, for improvements in the manufacture of sulphuric acid.

The above bear date July 6th.

1874. Charles Faulkner, and David Faulkner, both of Birmingham, for improvements in gun and pistol barrels, and in cannons; and in furnaces for the same.

1875. John Alison, of Hainault Forest, for improvements in preparing vegetable substances for feeding animals, and in apparatus for that purpose.

1876. William Dawes, of Wellington, Salop, for improvements in the pistons of steam-engines.

1877. Wilhelm Adolf von Canig, of Leipsic, for a new or improved compound or composition to be used as a substitute for gum, paste, and other adhesive materials, and for finishing, sizing, or stiffening fabrics and other articles to which the same is or may be applicable.

1878. Richard John Badge, of Newton-heath, near Manchester, for improvements in railway chairs.

1879. Joseph Platt, of Audlem, Cheshire, for improvements in gunlocks.

1880. Frederick Bousfield, of Hereford-terrace, De Beauvoir Town, for improvements in the manufacture of soap.

1881. John Speight, of Bradford, Yorkshire, for improvements in wool combing, and in machines known as Collier's combing machines.

1882. Peter Armand Le Comte de Fontainemoreau, of South-street, for certain improvements in apparatus for the manufacture of boots and shoes, which apparatus is also applicable for uniting other articles together,—being a communication.

1883. Peter Hippolyte Gustave Bérard, of Paris, for improvements in manufacturing azotic cotton or pyroxile for photographic and other purposes.

1884. Peter Hippolyte Gustave Bérard, of Paris, for improvements in manufacturing and applying concentrated collodion.

1885. John Louis Jullion, of Foot's Cray, for the mechanical and chemical separation of solids from fluids.

1886. William Smith, of Kettering, for improvements in horse-hoes and drills.

1887. Richard Archibald Brooman, of Fleet-street, for the manufacture upon circular frames of a fabric suitable for petticoats and other garments, curtains, and other articles of furniture,—being a communication.

1888. Richard Archibald Brooman, of Fleet-street, for improvements in vices,—being a communication.

1889. William Burgess, of Newgate-street, for improvements in reaping and mowing machines.

1890. Richard Archibald Brooman, of Fleet-street, for improvements in connecting carriages and waggons on railways,—being a communication.

1891. Michael Henry, of Fleet-street, for improvements in railways and waggons used therewith, in loading and discharging coals, stones, ballast, earth, and other materials,—being a communication.

The above bear date July 7th.

1892. William Edmondson Jones, of Glades Spring, Virginia, for an improvement in trees of riding saddles.

1893. John Talbot Pitman, of Gracechurch-street, for a conical tent,—being a communication.

1894. George Green, of Whitehorse-lane, Mile-End-road, for improvements in machinery for the manufacture of casks, barrels, and other similar articles.

1895. Thomas Frederick Henley, of Bromley, Middlesex, for improvements in the preparation or manufacture of certain beverages or liquors of the nature and character of home-made wines, and in the means of obtaining the same.

1896. Jules Joseph Henri Brianchon, of Paris, for improvements in coloring and ornamenting glass, porcelain, earthenware, and other ceramic substances.

1897. Joseph Gibbs, of Abingdon-street, for improvements in extracting gold and silver from their matrices, and from other substances or materials with which they are combined, mixed, or associated.

1898. Hilary Nicholas Nissen, of Mark-lane, London, for an improved method of making impressions similar to water-marks upon paper.

1899. Edward Taylor Bellhouse, and William John Dorning, both of Manchester, for certain improvements in hydraulic presses.

1900. Louis Albert Bahn, of Greek-street, Soho, for improvements in the manufacture and application of certain metallic alloys.

1901. Louis Albert Bahn, of Greek-street, Soho, for improvements in galvanizing metals, and in the apparatus employed therein.

1902. Nicolas Marshall Cummins, of Annmount, Cork, Ireland, for improved means for indicating the proximity of icebergs,—being a communication.

1903. Robert Moore, of Isleworth, for improvements applicable to navigable vessels and the propelling thereof.

The above bear date July 8th.

1904. Arthur Dobson, of Belfast, for improvements in machinery or apparatus to be used in bleaching, washing, starching, airing, and finishing fabrics, and in sizing yarns.

1905. Charles Patrick Stewart, and David Graham Hope, both of Manchester, for improvements in the valve gear of locomotive and other engines.

1906. John Holley Swan, of Royal Exchange-square, Glasgow, for improved machinery and steam-engine, for crushing quartz and other hard substances, and for amalgamating.

1907. John Dunsmore Mac Nicol, of Manchester, for improvements in machinery or apparatus for cylinder printing.

1908. John Julius Cléro de Clerville, of Newman-street, Middlesex, for improvements in the manufacture of oil-cloth and imitation leather,—being a communication.

1909. John Scott Russell, of Millwall, for improvements in apparatus and slips for moving ships and vessels out of, and into, the water.

1910. Richard Archibald Brooman, of Fleet-street, for an improvement in propelling ships, boats, and other vessels,—being a communication.

1911. Cosmo Logie, of the Royal Horse Guards, for an improvement in, or addition to, fire-arms.

1912. William Mann, of the City of London Gas Works, for an improved arrangement of steam-boiler, gauge-cocks, and registering apparatus connected therewith.

1913. Florentin Delmas, of Paris, for improvements in ventilating ships, mines, and other places.

1914. Thomas Lewis, and Henry Parrish, both of Birmingham, and Robert Martin Roberts, of Dolgelly, Merionethshire, for improvements in the separation and extraction of copper from its ores.

1915. William Johnson, of Lincoln's-inn-fields, for improvements in capstans,—being a communication.

The above bear date July 9th.

1916. Eastwood Eastwood, of Burnley, Lancashire, for improvements in picker bands for looms.

1917. Charles De Bergue, of Dowgate-hill, for an improvement or improvements in the manufacture of apparatus for condensing and cooling purposes.

1918. Thomas Vicars, sen., Thomas Vicars, jun., Thomas Ashmore, and James Smith, all of Liverpool, for improvements in the manufacture of bread, biscuits, and like articles, and in the machinery connected therewith.

1919. Isac Louis Pulvermacher, of Paris, for improvements in pipes and tubes for smoking.

1920. David Hope, of Bishop's Auckland, Durham, for an improved method of preventing one train from running into another on railways.

1921. Sir Francis Charles Knowles, of Lovell-hill, Berks, for improvements in the manufacture of iron.

1922. Richard Archibald Brooman, of Fleet-street, for a method of and apparatuses for scouring or extracting oil and grease from wools and woollen fabrics, and for extracting gum and gummy matter from silk,—being a communication.

1923. John Gill, of Newtyle, Forfarshire, N.B., for improvements in reaping machines.

1924. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the construction of furnaces and steam boilers,—being a communication.

1925. James Moon, of Malton, Yorkshire, Robert Belt, and George Ewbank, both of Lutton, Yorkshire, for an improved agricultural implement.

1926. William Smith, of Little Woolstone, near Fenny Stratford, for improvements in steam-engines for giving motion to agricultural implements.

1927. Webster Woodman, of Boulevart Montmartre, Paris, for improvements in railroad wheels,—being a communication.

1928. George Dyson, and Thomas Harrison, both of Tudhoe Iron Works, near Ferry-hill, Durham, for an improvement or improvements in steam-engines.

1929. Richard Hornsby, jun., of Spittlegate, near Grantham, for improvements in apparatus for hummelling, removing the husk from, and cleansing grain.

1930. John Chanter, and David Annan, both of Bow, Middlesex, for improvements in furnaces when moveable bars are used.

The above bear date July 10th.

1931. Edouard Primard, of Paris, for improvements in treating auriferous, argentiferous, or other metallic ores.

1932. William John Thomas Smith, and Frederick Talbot, both of Birmingham, for an improvement or improvements in hair pins.

1933. Datus Ensign Rugg, of New York, for an improvement in water-gauges for steam-boilers.

1934. John Loach, James Jones Salt, and Burton Day, all of Birmingham, for certain improvements in metallic air-tight coffins, as also in the mode of covering, finishing, and ornamenting such like coffins.

1935. François Burot, of Rue Neuve des Mathurins, Paris, for a new process for gilding and plating over silk, cotton, wool, and all other textile and fibrous matters.

1936. Peter Armand le Comte de Fontainemoreau, of South-street, for an improved shoe and boot scraper or cleaner,—being a communication.

1937. Bernard Denizot, and Charles Flipps, of Paris, for an improvement in the construction of railway breaks.

1939. Alexandre Amand Noël Dépinhay-Prèhamon, of Paris, for improvements in windmills.

The above bear date July 11th.

1940. Murdoch McKay, and Henry Forfar Osman, both of Essex-street, for improvements in apparatus for securing the points of railway switches.

1941. Henry Starr, of Liverpool, for improvements in hinges,—being a communication.

1942. Joseph Lester Hinks, and John Rock Day, both of Birmingham, for improvements in locks and latches, and in attaching lock and latch knobs to spindles.

1943. Nicholas Williams, and Thomas Williams, both of Helston, Cornwall, for improvements in the form and arrangement of the driving gear of thrashing machines, and in the form and mode of applying the straw shakers to such said machines.

1944. Peter Rector Smith, of New York, for improvements in fire-arms and ordnance.

1945. James Heywood Whitehead, of Saddleworth, Yorkshire, for improvements in milling endless cloths.

1946. William Edward Newton, of the

Office for Patents, 66, Chancery-lane, for improved machinery for converting old rope or cordage into tow,—being a communication.

1947. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the manufacture or reduction of platinum,—being a communication.

1948. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved construction of portable railway for steam traction engines on common roads or land,—being a communication.

1949. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved mode of preventing incrustations in steam-boilers—being a communication.

The above bear date July 13*th.*

1950. Samuel Nye, of Wardour-street, Middlesex, for improvements in chaff-cutting machines.

1951. Barnabus Urry, of Newport, Isle of Wight, for improvements in seed-drills.

1952. William Wyatt, of Bury St. Edmunds, for improvements in hay-making machines.

1953. Frederick Crace Calvert, of Manchester, and Charles Lowe, of Halifax, for improvements in the manufacture of size.

1954. Henry Hebblethwaite, William Shuttleworth, and William Tasker, all of Halifax, for improvements in preparing yarns for, and in machinery or apparatus employed in printing yarns for, carpets or other similar fabrics.

1955. James Webster, of Birmingham, for an improvement or improvements in safety-valves.

1956. William Stettinius Clark, of High Holborn, for improvements in machines for harvesting grain and grass crops, and in the automatic delivery thereof,—being a communication.

1957. Jeffries Kingsley, of Bedford-square, for obtaining or applying a primary motive power, namely, the water of a river, which causes a vacuum in an exhausting receiver, which may be transferred by tubes to other machines causing water and ores to be raised from mines; likewise causing the steam-engine to be superseded; water being cheaper than coals.

1958. Hugh Smith, and Frederick Moore Smith, both of Porchester-square, Middlesex, for an improvement in fire-arms.

1959. Gustavus Palmer Harding, of Jewin-street, London, for improvements in the manufacture of hats, caps, and other coverings for the head.

1960. Thomas Ashton, of Abbey Mills, Morpeth, Northumberland, for an improvement in teasing, scribbling, carding, and combing engines.

1961. Thomas Mosdell Smith, of Hammersmith, for improvements in the preparation of materials applicable to the manufacture of candles.

1962. William Henry Gauntlett, of Middlesbro'-on-Tees, for improvements in thermometric apparatus.

The above bear date July 14*th.*

1963. François Moulin, of Lyons, France, for a new improved railway brake.

1964. William John Locke, of Edgeley, Cheshire, for constructing an improved oil-can.

1965. John Henry Quick, of Pimlico, for an improved hat.

1966. Edmond Bertin, of Aldgate, for a new manufacture of fibre, suitable for the purposes to which hemp and flax are usually applied.

1967. Richard Archibald Brooman, of Fleet-street, for improvements in the manufacture of hats, bonnets, and other coverings for the head,—being a communication.

1968. Gavin Walker, and James Clachan, both of Glasgow, for improvements in looms for weaving.

1969. John Henry Johnson, of Lincoln's-inn-fields, for improvements in machinery or apparatus for marking or imprinting characters on paper and other fabrics,—being a communication.

1970. Henry Blandford, of Sandridge, Bromham, near Chippenham, for an improved combination of apparatus for distributing manure.

1971. John Henry Johnson, of Lincoln's-inn-fields, for improvements in sewing machines,—being a communication.

The above bear date July 15*th.*

1972. Wright Jones, of Pendleton, near Manchester, for improvements in moulding for casting metals.

1973. James Wright, of Alfred-place, Newington-causeway, for improvements in the manufacture of gas.

1974. John Cox, of Gorgie Mills, Edinburgh, for improvements in apparatuses to enable persons to progress in swimming.

1975. William Armand Gilbee, of South-street, for improvements in the treatment of fatty matters for the manufacture of candles and night-lights,—being a communication.

1976. Guillaume Defis, of Marseilles, for certain improvements in preventing incrustation in boilers.

1977. George Samuel Mathews, of Dublin, for improvements in railway breaks.

The above bear date July 16th.

1978. Charles Fréderic Vasserot, of Essex-street, for an apparatus for measuring and registering the flow of liquids,—being a communication.

1979. John Avery, of Essex-street, Strand, for improvements in steam-engines,—being a communication.

1981. Joseph Russell, of Woodland's-road, Blackheath, Henry William Spratt, of Granville-park, Lewisham, and William Press, of Stepney-causeway, for a certain new method or methods, or new improvement or improvements, in the construction, application, and use of machinery for propelling boats, ships, or vessels of any class or denomination.

1982. William Barwell, of Birmingham, for an improvement or improvements in casting metals.

1983. Thomas Foxhall Griffiths, of Birmingham, for an improvement or improvements in shaping metals.

1984. John Henry Johnson, of Lincoln's-inn-fields, for improvements in steam-boilers,—being a communication.

1985. Thomas Clunes, and John Macintosh, both of Aberdeen, for improvements in machinery or apparatus for bottling or supplying vessels with fluids.

1986. Alfred Upward, of Duncan-terrace, Islington, for an improvement in the manufacture of coke.

1987. Samuel Ramsden, of Hunslet, near Leeds, for improvements in the construction and fixing of window sashes.

1988. Thomas Roberts, and John Dale, both of Manchester, for improvements in obtaining pigments from dye-woods, and in the application of a pigment to printing paper-hangings.

The above bear date July 17th.

1989. Augustus Dacre Lacy, of Hall House, Knayton, Yorkshire, and William Collett Homersham, of Adelphi-terrace, for improvements in machinery for ploughing and cultivating land by steam or other suitable motive power.

1990. James Austin, of Donaghadee, county Down, Ireland, for improvements in machinery or apparatus for ploughing or cultivating land.

1991. William Cliff, of the Queen's Hotel, St. Martin's-le-Grand, for a new system of applying the air from the bellows and other means to the forge,—being a communication.

1992. George James Wainwright, and Charles Timothy Bradbury, both of Dukinfield, Cheshire, for improvements in apparatus for diminishing the amount of waste in the use of cops for manufacturing purposes.

1993. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for cutting metals or other hard substances,—being a communication.

1994. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improved construction of combined steam-boiler and radiator for warming apartments or buildings,—being a communication.

The above bear date July 18th.

1996. Richard Bolton, of Blackburn, for an improved mode of weighting the yarn-beam in looms used in the manufacture of cloth by steam-power.

1997. George John Newbery, of Straitsmouth, Greenwich, for improvements in window blinds.

1998. Frederick Hall Holmes, of Blackwall, for improvements in magneto-electric and electro-magnetic machines.

1999. Hugh Smith, of Porchester-square, Middlesex, for an improved

agricultural implement for pulverizing and cleansing land.

2000. Richard Archibald Brooman, of Fleet-street, for improvements in the manufacture of pipes and tubes,—being a communication.

2001. Thomas Restell, of New Kent-road, for improvements in breech-loading fire-arms, and in fastening the barrels of fire-arms to their stocks.

2002. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for feeding flour and mixing and kneading dough for the making of bread and biscuits, —being a communication.

2003. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in reaping and mowing machines,—being a communication.

2004. Robert James Mary'on, of Hooper-street, Lambeth, for improvements in the construction of propellers and in arrangements of engines for working the same for propulsion of ships or vessels.

2005. Henry Vennor Cowham, of Skeffling, Yorkshire, for improvements in machinery for breaking or pulverising land.

2006. Joseph Conway, of the Margam Copper Works, Taibach, South Wales, for improvements in the production of copper rollers for printing calico and other fabrics.

2007. Samuel Butler, of Nottingham, for improvements in the manufacture of ornamental bobbin net, or twist-lace.

The above bear date July 20th.

2008. Josiah Claughton Arnall, and George Greenhow, both of the Yorkshire Glass Bottle Company, Ferry Bridge, near Pontefract, for improvements in the manufacture of glass bottles and jars, and in the apparatus connected therewith.

2009. George Parsons, of Martock, Somersetshire, for improvements in thrashing machines known as combined thrashing machines.

2010. Frederick Warner, of Jewin-crescent, for improvements in ball and other cocks and valves.

2011. Andrew Scott, of Charlotte-terrace, Copenhagen-street, Islington, for improvements in stops for gates and doors.

2012. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for manufacturing screws, or screw-caps, of sheet-metal,—being a communication.

2013. Josef Mohr, of Vienna, for improved machinery for propelling vessels.

The above bear date July 21st.

2014. William George Armstrong, of Newcastle-upon-Tyne, for improvements in the mode of adjusting ordnance for fire by night or day.

2015. James Hall, of Lancaster, for improvements in the mode of preventing incrustation in boilers.

2016. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for grinding and polishing stone, glass, and other materials,—being a communication.

2017. Joseph Kirby, of Bodicote, Oxon, for improvements in hay and other rakes.

2018. Henry Doulton, of Lambeth, for improvements in the manufacture of earthenware drain and other pipes.

2019. Murdoch Mc Kay, of Hackney, and Lewis Rose, of Holborn, for improvements in apparatus to be used in washing and scouring household linen and other textile fabrics.

The above bear date July 22nd.

2020. John King, of Cannon-street, for improvements in the preparation of peat and peat coke or charcoal, and in machinery or apparatus for that purpose,—being a communication.

2021. Moses Clark, of Saint Mary Cray, and George Bertram, of Edinburgh, for improvements in machinery or apparatus for cutting paper.

2022. William Deakin, and William Phillips, both of Birmingham, for certain improvements in the manufacture of metallic pens and pen-holders.

2025. William Hudson, of Burnley, Lancashire, and Christopher Catlow, of Clithero, in the same county, for certain improvements in looms for weaving.

2026. Edwin Wilson, of Worcester, for an improved method of consuming smoke.

2027. Charles Norris, of the Calder Chemical Works, Sowerby Bridge, Yorkshire, for improvements in the manufacture of sulphate of alumina and the application of the same, so manufactured, in dyeing, printing, paper making, and such like purposes.

The above bear date July 23rd.

2028. Joseph Needham, of Piccadilly, for improvements in fountain pens.

2029. James Burrows, of Wigan, Lancashire, for certain improvements in steam-engines.

The above bear date July 24th.

2031. Joseph Bennett, of Pimlico, for improvements in boring tools for wells, shafts, and like purposes.

2033. John Scott Collins, of Liverpool, for improvements in reefing and furling of ships' and other vessels' sails, and in the manufacture of the same.

2034. Julius Schönemann, of Portland-street, for improvements in the construction of weighing machines,—being a communication.

2035. Frederick Oetzmann, and Thomas Luis Plumb, both of Great Russell-street, Bloomsbury, for improvements in upright piano-forte actions.

The above bear date July 25th.

2036. John Gedge, of Wellington-street South, for improvements in doubling machines,—being a communication.

2037. William Williams, of Dale, Pembrokeshire, for improved graving slips for the repairing of ships.

2038. William Blake Williamson, of Bradford, Yorkshire, for improvements in looms employed for weaving textile fabrics and fibrous materials.

2039. John Walter Friend, of Freemantle, Southampton, for an improved meter for registering the flow of water and other liquids.

2040. Richard Archibald Brooman, of Fleet-street, for improvements in motive power engines,—being a communication.

2041. Nicholas Saintard, of Paris, for an improved break for railway and other carriages.

2043. Joseph Ridsdale, of the Minories, for an improvement in ships' scuttles.

2045. Benjamin Richardson, of Wordsley Flint Glass Works, near Stourbridge, for an improvement in the manufacture of articles in glass, so as to produce peculiar ornamental effects.

2046. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in apparatus for retarding and stopping carriages on railways,—being a communication.

2047. James Henry Bennett, of Birmingham, for improvements in engines to be worked by atmospheric pressure or steam, or by both in combination, and also in steam generators to be used therewith.

2048. Patrick Danvers, of New York, and George Whitfield Billings, of Plainfield, New Jersey, U.S.A., for an improved means for rolling hoops and wheel tyres.

2049. James Higgin, of Manchester, for an improved method of drying garancine or other moist substances.

2050. William Stettinius Clark, of High Holborn, for improvements in automatic feeding printing press,—being a communication.

2051. Edward Hallen, of Cornwall-road, for improvements in the construction of bedsteads and similar articles to recline or sit on.

2052. Octavius Henry Smith, of the Thames Bank Distillery, for an improvement in supplying steam to water to heat the same, and in preventing what is technically called priming of steam.

2053. William Hirst, of Bath, for improvements in manufacturing felted fabrics.

2054. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in apparatus for feeding water to steam-boilers,—being a communication.

2055. Prosper Brunot, of Boulevart de Sebastopol, Paris, for improvements in springs for petticoats and other articles of dress.

2056. Robert Jackson, of Glasgow, for improvements in protecting certain parts of the body from disfigurement by cutaneous diseases.

2057. William Proctor, of Bristol, for

improvements in the manufacture of sulphuric acid.

2058. Edward William Baxter, of Sidney-street, Mile-End, for an improved mode of preparing glass labels, advertising tablets, and, ornamental devices upon glass.

2059. Jules Dortet, and André Barthelemy Denis, both of Paris, for an improved safety padlock.

2061. Thomas Till, and William Gardiner, both of Birmingham, for an improvement or improvements in preventing collisions on railways.

2062. John Clay, of Birmingham, for an improvement or improvements in saddles.

2063. John Bethell, of Parliament-street, for improvements in the construction of ships and other vessels.

The above bear date July 28th.

2064. Charles William Siemens, of John-street, Adelphi, for improvements in refrigerating and producing ice, and in apparatus or machinery for that purpose.

2065. John Bertwistle, and Daniel Bertwistle, both of Padiham, Lancashire, for improvements in ventilating.

2066. Hartley Kenyon, of Manchester, for improvements in the treatment of certain compounds of silica, alumina, sodium, or potash, and the application of such compound in the processes of printing, dyeing, tawing, paper making, or in any other process in which the alumina of commerce is employed.

2067. Samuel Lawrence Taylor, of Cotton End, Bedfordshire, for improvements in steam-engines.

2068. William Edward Jones, of Birmingham, for improvements in the manufacture of iron plates, such as boiler plates, plates for ship-building, and other similar purposes, and also in machinery for the manufacture of such plates.

2069. William George Plunkett, of Belvidere-place, Dublin, for improvements in the application of new materials to the manufacture of paper pulp and yarn for textile fabrics, cordage, &c.

2070. George Hallen Cottam, and Henry Richard Cottam, of the St. Pancras Iron Works, for improvements in the manufacture of children's cots and metallic bedsteads.

2071. Jonathan Burnett, of Newcastle-upon-Tyne, for improvements in the manufacture of chloride of lime, or bleaching powder.

The above bear date July 29th.

2072. William Stettinius Clark, of High Holborn, for improvements in kegs for holding gunpowder and articles of a similar nature,—being a communication.

2073. James Purcell, of Mount-street, Whitechapel-road, for improvements in attaching or securing buttons to articles of clothing.

2074. Samuel Coulson, of Sheffield, for improvements in preparing solutions for coating with aluminium.

2075. William Mc Kinley, and Robert Walker, of Paisley, for an improvement in the manufacture of moulds for forming the soles of boots and shoes.

2076. Thomas Ivory, of Edinburgh, for improvements in rotary and reciprocating engines.

2077. John Frearson, of Birmingham, for improvements in feeding, cutting, shaping, and piercing metals.

2078. Henry Bauerrichter and Gustavus Gottgetreu, of Charterhouse-square, for improvements in the arrangement or adaptation of stereoscopic apparatus, and in boxes or cases for containing the same.

The above bear date July 30th.

2079. James Alfred Limbert, engineer, Royal Navy, for improvements in marine engines.

2080. Edward Evans, of Holywell, Flintshire, and George Potts Roskell, of Stockyn, near Holywell, for improvements in reaping and mowing machines.

2081. Luke Cooke, of Blackburn, for improvements in machinery or apparatus for preparing cotton, wool, or other fibrous substances to be spun.

2082. Henry Bernoulli Barlow, of Manchester, for certain improvements in self-acting mules for spinning,—being a communication.

2083. Thomas Forsyth, of Manchester, for improvements in and applicable to slide valves for steam-engines,—being a communication.

2085. Antoine Galy-Cazalat, & Adolphe Huillard, of Paris, for an improved apparatus for and mode of manufacturing sulphuret of carbon, animal charcoal, and carbonic acid.

2086. Thomas Markland, of Hyde, for certain improvements in power looms for weaving.

2087. Henry Genhart, of Liege, Belgium, for an improved apparatus for cleaning and sharpening knives, and cleaning spoons and forks.

2088. William Garnham, of Bedford-terrace, Chelsea, for improvements in pumping apparatus.

2089. George Inman, of Susannah-street, Poplar, for an improved construction of locomotive engine.

2090. John Beale, of East Greenwich, for an improved construction of rotary engine, applicable for pumping and measuring fluids, or for the production of motive power.

The above bear date July 31st.

2091. William Jewett Harris, of Greenwich, for improvements in the construction of dining and other tables.

2092. Charles Avril, of Paris, for improvements in the mode of forming the printing surface of blocks, plates, cylinders, lithographic stones, or other similar bodies made use of for printing in colors.

2093. Richard Coleman, of Chelmsford, for improvements in implements for ploughing, hoeing, and scarifying land, and in agricultural steam-engines used for the traction of such implements.

2094. Guillaume Felix Aroux, of Paris, for improvements in seed drills.

2095. James Tatlow, and Henry Hodgkinson, both of Wirksworth, Derbyshire, for certain improvements in railway breaks and signals.

2096. Edwin Maw, of the Doncaster Iron Works, for improvements in constructing railway crossings, points, and switches.

2097. Thomas Rickett, of the Castle Foundry, Buckinghamshire, for improvements in implements for cultivating land.

2098. William Hopkinson, of Huddersfield, for certain improvements in steam-engines.

2099. Augustin Julien Michel Ramar, of Broad-street, Golden-square, for improvements in ornamental and portable fountains.

2100. Richard Archibald Brooman, of Fleet-street, for improvements in circular sawing machinery,—being a communication.

2101. George Brooks Pettit, and Henry Fly Smith, of Oxford-street, for an improved cap or cover for the glasses of gas and other lights.

2102. John Gray, of Peckham, for certain improvements in doors for furnaces and fire-places.

The above bear date August 1st.

2103. Robert Davison, and James Lee, both of Limerick, for improving the edge or selvage of linen, cotton, woollen, silk, or any other cloth or fabric, while in the act of weaving.

2104. John Elce, and John Leach, both of Manchester, for improvements in self-acting temples for looms.

2105. Leon Duriez, jun., of Paris, for an improved apparatus for stopping horses.

The above bear date August 3rd.

2106. Richard Birch, and Robert Bradbury, both of Haughton, near Denton, Lancashire, for improvements in machinery and apparatus for clearing and mixing hatters' furs.

2107. Eugène Antoine Dumergue, of Paris, for a new description of fringes.

2108. Alexander Prince, of Trafalgar-square, for a substitute for varnish, turpentine and oil, in the manufacture or mixing of paints and pigments, to be employed for coating or covering wood, metal, glass, and other substances, to preserve them from atmospheric influences and fire,—being a communication.

2109. Peter Macpherson, of Edinburgh, for improvements in wheeled carriages or vehicles.

2110. John Henry Johnson, of Lincoln's-inn-fields, for improvements in sewing machines,—being a communication.

2111. Charles Iles, of Birmingham, for improvements in the manufacture of thimbles.

The above bear date August 4th.

New Patents.

Sealed under Patent Law Amendment Act, 1853.

1857.

57. C. F. Claus.
183. Thomas Harris.
189. James Warne.
197. Robert Johnstone.
198. William Roberts.
199. H. W. Wimshurst.
203. George Bedson.
204. C. F. Vasserot.
209. J. F. Powell.
213. T. and R. A. Ayles.
214. P. H. Sharkey.
216. James Harris.
218. C. J. Wiggs.
227. W. L. Tizard.
229. R. A. Brooman.
238. W. A. Turner.
239. G. L. Doelling.
249. W. H. Sisterson.
250. R. A. Brooman.
258. G. E. Dering.
260. C. E. Symonds.
263. G. and J. Sampson and E. Ledger.
265. Charles De Bussy.
267. William Weild.
270. J. T. Pitman.
277. F. W. Campin.
282. Henry Smith.
283. Thomas Affleck.
284. James Owen.
288. Duncan Morrison.
289. William Hargreaves.
294. Daniel Howarth.
296. William Dray.
297. W. H. Holding and J. R. Casbay.
298. Cotton Symonds.
301. J. F. Durebout.
305. Robert Morrison.
307. T. W. Rayner.
308. James Hunt.
309. Florentin Garand.
311. Richard Laming.
323. Samuel Hart.
324. C. De Bergue.
331. P. and F. Schäfer.
338. H. Myers and C. and J. Askew.
339. William Green.
340. R A. Brooman.
351. Charles Crickmay.
354. J. N. V. Cadiat.
355. Joseph Skertchly.
356. W. Greenslade and J. Woods.
358. F. L. Bauwens.
359. T. Brown and G. Parry.
360. R. A. Brooman.
361. R. A. Brooman.
368. Henry Cartwright.
372. David Falconer.
373. John Harding.
376. Henry Willis.
377. W. T. Walker.
378. Abel Stokes.
381. B. W. Owrid.
382. J. Graham, J. Shepherd, and T. Whitaker.
385. A. Chambers and W. H. Champion.
386. George Bedson.
387. A. F. W. Partz.
391. W. W. Pilcher.
392. A. Royds and J. Kenyon.
394. Thomas Howard.
395. H. and A. Heald.
397. J. T. Pitman.
398. J. T. Pitman.
400. W. and J. Todd.
402. R. D. Kay.
403. John Poole.
404. John Macintosh.
406. G. C. Potts.
407. Joshua Horton, jun.
410. P. H. Desvignes.
414. J. and R. Blackburn.
419. George Gimson.
422. C. Crossley, D. Leeming, and J. Crossley.
424. William Richardson.
426. D. A. Lamb.
429. N. C. Smith.
430. M. W. Hallett.
431. J. Lawson and S. Cotton.
432. George Hardstaff.
433. Richard Houchin, jun.
437. A. B. Walker.
441. J. Firth and J. Crabtree.
442. Archibald Smith.
443. James Taylor.
445. William Cooke.
447. W. R. Jackson.
448. W. E. Newton.
450. Thomas Newcomb.
455. William Clark.
456. Thomas Ball.
463. Emile Alcan.
464. Harby Barber.
465. J. B. Pascal.
467. F. B. Houghton.
472. Jacob Green.
476. Julien Blanc.
479. David Cheetham.
480. Samuel Dyer.
481. L. L. Foucher.
483. G. F. L. Meakin.
484. D. L. Price.
489. William Clark.
491. Henry Y. D. Scott.
495. Edward Edwards.
498. J. R. Crook.
499. John Combe.
502. W. Zipser and J. P. Klein.
508. John Whitehead.

509. F. H. Thomson.
511. John Barber.
512. J. Middleton and W. Stent.
513. John Turner.
516. Michael Grouse.
518. William Gossage.
519. A. Quidde and C. Mayet.
524. James Brown.
525. F. C. La Croix.
526. G. Devincenzi.
527. J. E. Shearman.
528. John Kirkham.
531. J. H. M. Massiat.
534. George Barnett.
535. J. Milnes and W. Thompson.
536. C. F. Latruffe.
537. R. A. Brooman.
540. Joseph Robinson.
543. J. H. Johnson.
549. J. Fenton.
553. L. E. O. Degrand.
556. J. H. Johnson.
561. T. G. Shaw.
566. C. Bruton, sen., C. Bruton, jun., F. J. Bruton, & S. R. Bruton.
567. J. S. Edwards.
568. William Mills.
569. B. Hodgson and J. Carter.
570. Victor Cassaignes.
575. W. Robertson, J. G. Orchin, and J. Menzies.
583. W. E. Newton.
595. R. A. Brooman.
596. H. D. P. Cunningham.
597. T. H. Jennens.
598. James Murphy.
603. William Pedder.
607. F. W. Mowbray.
608. Charles Pauvert.
609. Charles Pauvert.
610. Charles Pauvert.
616. Thomas Gray.
626. W. E. Newton.
629. Robert Mair.
631. Gerard Ralston.
632. Thomas Brown.
636. W. E. Newton.
639. G. W. Dyson.
642. J. L. F. Bardin.
644. William Holland.
659. L. Barton and E. S. Brookes.
680. J. A. Cumine and C. Hunter.
685. C. C. Dennett.
687. W. E. Newton.
688. W. E. Newton.
704. William Makin.
718. W. E. Newton.
749. W. E. Newton.
751. Modeste Auguetin.
753. William MacNaught.
784. N. J. Greenwood.
799. J. E. Cole.
807. H. and E. T. Dolby.
839. Charles Cowper.
846. George White.
847. Dominico Tomasini.
879. J. H. Johnson.
894. R. A. Wright.
911. George Lowry.
923. W. H. Box.
1008. Robert Turnbull.
1030. T. R. Winder.
1037. J. and E. Ratcliff.
1042. R. A. Brooman.
1053. R. A. Brooman.
1101. Henry Heald.
1118. W. Crighton and P. Foxcroft.
1156. J. T. Way.
1177. Joseph Belshaw.
1192. Wilson Ager.
1224. G. T. Bousfield.
1247. J. P. Booth.
1248. P. Fairbairn and T. Marsden.
1260. J. A. Petiet.
1272. H. E. Hoole.
1286. P. A. Le Comte de Fontainemoreau.
1295. John Stenhouse.
1302. Caleb Tayler.
1303. C. E. Darby.
1316. H. Hobbs and E. Easton.
1320. C. W. Siemens.
1327. A. V. Newton.
1345. Stephen Yeldham.
1357. G. W. Morse.
1393. R. Bradley, and W. Craven.
1397. W. E. Newton.
1404. E. A. Cowper.
1407. William Whitehead.
1413. John Hardley.
1446. J. T. Wright and E. P. Wright.
1447. F. Walton and J. Pinson.
1472. H. W. Tyler.
1481. J. E. Cook.
1528. Dr. H. Bleibtreu.
1533. F. C. Warlich.
1534. G. W. Pye and Thomas Oldknow.
1547. Stanislaus Hoga.
1571. Chérie Martel.
1578. R. H. Collier.
1598. A. F. Sherman.
1602. John Brown.
1612. John Gedge.
1617. Thomas Hale.
1625. G. Jarrett.
1635. W. E. Newton.
1643. William Wilkins.
1646. James Buchanan.
1654. Malcolm Macdonald.
1658. Thomas Turner.
1695. Frederick Warner.
1727. Henry Dunington.
1731. L. St. Lawrence Bunn.
1770. J. Exley and J. Ogden.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S

London Journal of Arts and Sciences.

NEW SERIES.—No. XXXIV.

THE LIFE OF GEORGE STEPHENSON, RAILWAY ENGINEER.—*By* Samuel Smiles.*

There are few among the many illustrious men who have stamped their names upon the tablet of time whose lives will yield more profit to the student than that of George Stephenson. Born of humble parents, in an obscure village, he grew up to manhood in ignorance and obscurity; and yet, by the vigorous exercise of mental faculties scarcely exceeding those of ordinary men, he achieved results, the beneficial extent of which, to mankind, it is simply impossible for the imagination to realise.

His father, an honest, sober man, whose occupation as fireman to the pumping engine of a collier at Wylam, a village about eight miles from Newcastle-on-Tyne, yielded him but the small weekly pittance of 12*s*., could ill afford education for his son George, who was the second of six children; he was therefore left to grow up with little, if any, more knowledge, than that *work* was the heirloom of his family, and that, in virtue of the privileges of his class, he would inherit his birthright early. In front of the cottage where George Stephenson was born (June 9th, 1781), ran a wooden tramway, over which the waggons, laden with the products of the colliery, were drawn by horses; the child was therefore early initiated into the means of easing the draft of loaded carriages. His first essay at productive labor was to tend the cows of a neighbour, who had the privilege of grazing them along the waggon ways. For this duty he gained the wage of twopence a day; but as it was light work he occupied his spare hours in birds-nesting, and in making lilliputian water-mills, and clay models of engines. When older, he was set to lead the plough and to hoe turnips, at the advance of fourpence a day. His next rise was to colliery work, when he received first sixpence and then eightpence per day. He had now grown to a "grit bare-legged laddie, very quick witted, and full of tricks." As time rolled on, and he had proved himself capable of greater things, he was appointed assistant fireman, at one shilling a day; and on the opening of a new "working" in the neighbourhood, he was placed there as fireman on his own account, where he remained for two years. He had now in view the acquirement of sufficient knowledge of his engine to qualify himself for engine-man, and this object he diligently pursued until he had attained it. At this part of his career his ambition was not very soaring, for on receiving an unexpected advance to twelve shillings a week, he considered himself a made man for life. Here was steady progress, indicating plodding perseverance, but nothing more. His services now commanded as good pay as his father's, and at the age of sixteen he passed him, being appointed "plugman," which is a higher grade than that of fireman, requiring more practical knowledge. Being of an enquiring turn of mind, he now began to feel how circumscribed were his means of gathering information; he therefore joined an evening school, frequented by colliers and labourers' sons, where the draughts

* John Murray, Albemarle Street.

from Helicon were very niggardly doled out. He soon, however, learned to read, and at the age of nineteen was proud of being able to write his own name. The arrival of a Scotch dominie in the neighbourhood, profound in arithmetic, enabled him to add that branch of knowledge—or all that the master could teach him—to his scanty store.

While occupied in these pursuits he did not forget the main chance, but strove to perfect himself in all the duties of a colliery labourer. To this end he now added the knowledge of brakeing an engine, after meeting with considerable opposition from a fellow-workman, who considered him an interloper. Having qualified himself for this duty, he obtained the post of brakesman at the Dolly pit, Black Callerton, being now twenty years of age. "He had still," says his biographer, "only the tastes and ambitions of an ordinary workman, and perhaps looked not beyond that condition. The feats in which he took most pride were his feats of strength, in which he certainly excelled most of his fellows." In this situation, having gained a considerable increase of wages (his fortnight's earnings averaging little less than £2), and seeing perhaps a prospect of improving his position, he strove to put by a little money, and in order to increase his store, he applied himself, during his leisure hours, to mending the shoes of his fellow-workmen; and on one occasion he was favoured with the shoes of his sweetheart to sole. By thus diligently employing his time he managed to accumulate a small sum, sufficient to enable him, as a prudent man, to marry, which he did in the latter end of the year 1802. Leaving Black Callerton, George Stephenson went to Willington Quay, and acted as brakesman to a fixed engine at the summit of the Willington Ballast Hill, employed to draw the trains of laden waggons up the incline. It was while living at this place that his son Robert was born, who was destined in after years so materially to assist his father in his arduous undertakings. At the expiration of a three years' engagement he was induced to accept similar employment at the village of Killingworth, which lies about seven miles from Newcastle, and overlooks the valley of the Tyne. Here he lost his wife, soon after settling in his new abode, and desiring perhaps, in consequence, a change of scene, he embraced the offer to superintend the working of a Boult and Watt's engine, at Montrose. After a twelvemonth's residence in Scotland, where he had managed to save £28, he returned to Killingworth, which was to be the scene of his earliest labors in the advance of practical science, and found his father reduced to great distress, owing to an accident which deprived him of his sight. His first care was to provide for his aged parents, whom he placed in a cottage, near West Moor Pit, at which he resumed the post of brakesman.

About this period, owing partly to the gloomy prospect before the working classes, caused by the great European struggle then going on, and increased, in his case, by the parental claims now pressing upon him, our future railway engineer resolved to emigrate, but was happily prevented by his poverty. To increase his pecuniary resources he added shoemaking to his accomplishments, and further undertook the cleaning and repairing of his neighbours' clocks and watches; and he was thus enabled to provide funds for his son's schooling. During this period, and indeed throughout his whole career, he was a diligent collector of facts, which he not only stored, but usefully applied. In order that he might master the details of the steam-engine, he made a habit of taking to pieces, on Saturdays, the engine under his care, and cleaning and putting it together again. His mind seemed now to

have expanded, and he began to suggest improvements; the first of which was the re-arrangement of the pit gearing, whereby the wear and tear of the rope was considerably diminished. When any mechanical difficulty occurred in the neighbourhood, he made it his business to enquire into the circumstances, and watch the progress of the engineers engaged in removing it. Thus, in the year 1810, his attention was arrested by the long-continued and unsuccessful attempts made to clear a neighbouring pit of water, by means of a Newcomen engine; and in discussing the matter with a workman of his acquaintance, after several visits of inspection, he expressed his conviction that he could alter her, and make her drain the pit in a week. To his surprise, he was invited by the manager of the pit to try his hand, and by his success, obtained the local reputation of a "pump-curer." We now, for the first time, detect in the workman, the incipient engineer; his observations, ripening under the genial influence of common sense, had, without the aid of science, brought forth fruit, and given him confidence in his own judgment. Fortunately, about this time, Stephenson made the acquaintance of John Wigham, a farmer's son, who was a good penman and arithmetician, and was, moreover, fond of dabbling in experimental chemistry and mechanics. Spending his leisure evenings with this young man, the humble brakesman got an insight into the higher branches of arithmetic, acquired the art of drawing plans and sections, and improved his mind on general subjects. For a long time he strove to discover that *ignis fatuus* of amateur mechanicians, "perpetual motion;" but in other projects he was more successful, for he gained the admiration of the colliers' wives by connecting their cradles with the smoke-jack, and making them self-acting; and he astonished the pitmen by putting an alarum to the watchman's clock. In 1812, George Stephenson was appointed engine-wright at Killingworth, at a salary of £100 per annum, on the recommendation of the manager of the pit where he had so greatly increased the efficiency of the pumping engine. Being now in a measure relieved from manual labour, he began to plan new machinery for the several pits belonging to the lessees of his colliery; and these proving successful, he gradually acquired the confidence of his employers, who were a company of noblemen known as the Grand Allies. His son Robert, whom he had placed at school at Newcastle, having joined a literary and philosophical society at that place, was commissioned by his father to glean information for him from the library books; and the works on science which he was enabled to collect from this source, afforded profitable subjects both for discussion with his friend John Wigham, and for subsequent reflection. Having abandoned his dreams of perpetual motion, he turned his attention to improving the ways over which the coal waggons travelled from the pit's mouth to the shipping staiths, on the Tyne. Where the nature of the ground would allow, he laid down inclined planes, and applied the gravitating force of a descending train of loaded waggons to draw up an empty one to the higher level. But in order to expedite and reduce the cost of haulage, which had hitherto been effected by horse-power, he considered the possibility of employing a travelling engine; and for the purpose of gathering information on the subject, he paid several visits to his birth-place, Wylam, to inspect Mr. Blackett's engines, which he had built after Trevethick's invention, and employed with little or no pecuniary advantage. Stephenson also studied the construction of Blenkinsop's Leeds engines, constructed by Fenton and Murray, and concluded

that he could make a better engine than either of these. Here, as in many other new fields of investigation, an imaginary difficulty had been created, tending greatly to retard the progress of steam traction; and it was to the credit of Mr. Blackett, an enthusiastic advocate for travelling engines, that he exploded the fallacy that the weight of the engine would not of itself ensure sufficient adhesion between the wheels and rails for the purposes of propulsion. Stephenson having matured his ideas on steam locomotion, brought the subject under the notice of the lessees of the Killingworth colliery, in the year 1813, and on the authority of Lord Ravensworth, the principal partner, he built his first engine. Without a tithe of the facilities which are now to be found in the smallest engineer's shop in the kingdom, he produced this engine; but it was no great success in point of economy, for after a year's working, "the steam power and horse power were ascertained to be as nearly as possible upon a par in point of cost. * * The speed of the engine was not beyond that of a horse's walk, and sufficient steam could not be raised to enable it to accomplish more, on an average, than about three miles an hour." Here was by no means a satisfactory result, but a slight alteration in the engine served to double the steam generating capacity of the boiler: this was merely throwing the eduction steam in a vertical stream into the chimney, whereby the draft of the fire was greatly increased, and a corresponding evaporating power obtained. Certain defects in the details of the engine becoming apparent in the working of it over the very imperfect ways which were then in use, Mr. Stephenson, conjointly with Mr. Ralph Dodds (who provided the necessary funds), obtained a patent in the year 1815, for "various improvements in the construction of locomotive engines," the chief objects of which were first, to connect the piston-rods with the axles of the driving wheels in a manner that would allow for the rise and depression of the wheels, when running over unevenly laid rails; and secondly, to connect the fore and hind wheels together, without the use of cog gearing. The manner of attaining these ends affords very little evidence of mechanical ingenuity, even allowing for the backward state of practical mechanics at that day; but the experience gained by building the first engine enabled our persevering experimentor to build a second, which was found to answer extremely well.

It would have been strange, indeed, if a man so watchful of all that was going on around him, as was George Stephenson, had not given some attention to the means of remedying the fearful calamities caused by the explosions in coal mines. He had witnessed the horrors of these underground conflagrations, and shewed his readiness, on more than one occasion, to run any personal risk in order to prevent the recurrence of such a calamity. One day, says his biographer, in the year 1814, a workman hurried to Mr. Stephenson's cottage, with the startling information that the deepest main of the colliery was on fire. He immediately hastened to the pit's mouth, descended the shaft, leaving above a terror-stricken crowd of women and children, only to join a group of despairing work-people below, who were paralyzed with fear at the danger which threatened them. Selecting six from this number, who gained confidence by his sudden and unexpected appearance, he proceeded, with their aid, to brick up the entrance to the main, and by thus cutting off access of air thereto, the fire was speedily extinguished. To a man furnished by nature with nerve to achieve such a daring exploit, which saved the miners from death and preserved the works intact, it will be readily

understood, that when he desired to make himself more familiar with the subtle fluid which dealt such sudden destruction to life and property as he had witnessed, the danger of the pursuit held no place in our hero's thoughts. While experimenting on fire-damp in Killingworth mine, the pitmen, although proverbially reckless themselves, used to expostulate with him, says his biographer, believing that the experiments were fraught with danger. The result of these experiments was what the pitmen to this day call, the "Geordy" safety-lamp, which (from its coming into notice at the same time that Sir Humphrey Davy, then in the zenith of his fame, had, by a process of induction, invented the "Davy lamp") caused in after years a considerable explosion of ill-temper and display of wounded vanity, where, considering all the circumstances, calmer and less disingenuous conduct would have been more in place. Mr. Smiles is very earnest, even to the encumbering of his narrative, to shew that the unknown engineer had the start of the great philosopher; and was the first to put to a practical test the power of a porous metallic medium to intercept the passage of the flame from the interior to the exterior of the lamp. The unhesitating manner in which Stephenson advanced alone, with his untried lighted lamp, into a fiery part of the mine, where failure would have been certain destruction, brings prominently forward that trait in his character which enabled him to triumph over the opposition which, in after life, he had to contend with in establishing the modern system of travelling.

Having succeeded in effecting the economical application of steam locomotion to the hauling of coal-waggons, Stephenson's next attempt was to improve the ways on which they ran. In the specification of a patent which he took out in the year 1816, conjointly with Mr. Lock, of Newcastle, a wealthy and enterprising iron-master, he describes several improvements in rails and chairs, the object of which is to give stability to the permanent way, and enable the wheels to run smoother thereon. There is also included improvements in wheels, and a curious contrivance for effecting an elastic connection between the wheels and the body of the locomotive engine. We are told that the engines built according to this patent, in 1816, are still in constant use on the Killingworth railway. It would ill become us to doubt this assertion, but we should feel disposed to insinuate that they must have had some little repairs, not to say alterations, even to the removal of the steam springs, which Mr. Smiles considers "so strikingly characteristic of mechanical genius."

Having in a measure conquered the difficulties of steam locomotion on railways, Mr. Stephenson, in common with many other experimenters, took under consideration the practicability of adapting steam-carriages to the high roads. For this purpose he carried out a series of experiments, in conjunction with Mr. Nicholas Wood, on the resistance to which carriages were exposed on railways; and proved, to his own satisfaction at least, the impracticability of employing steam on common roads, and the great advantage derivable from laying down railways, at or near a dead level. The subject of railways, whose utility had been practically recognised for more than a hundred years, was now about to receive public attention, prior to the universal adoption of that system of communication. As early as the year 1818, Mr. Edward Pease, of Darlington, had, with the assistance of his friends, applied for an Act to authorise the construction of a tram-road from Witton to Stockton; but owing to the proposed line running near one of the fox-

covers of the Duke of Cleveland, that nobleman succeeded in throwing out the Bill. The application being, however, renewed in a new Parliament, an Act was obtained in 1821, for a railway from Stockton to Darlington. Nottingham also produced a railway propagandist, in the person of Mr. Thomas Gray, who, by means of the press and ceaseless persecution of public men, did much to prepare the public mind for the coming revolution. The success of Stephenson at Killingworth induced the proprietors of Hetton Colliery to solicit his assistance in laying down a line of eight miles for their use. He completed this work to their satisfaction, in the year 1822, and placed on the line five locomotive engines. While this work was in hand, Stephenson, hearing of the Stockton and Darlington project, introduced himself to Mr. Pease, and soon gaining the confidence of that gentleman and his friends, was requested to re-survey the line, and make such suggestions as might occur to him for the improvement of the undertaking. This resulted in the obtaining a new Act, and the appointment of George Stephenson as engineer to the line, at a salary of £300. per annum. The company having taken the advice of a man of experience, now found themselves committed to the construction of a rail, in contradistinction to a tram-way, and also to the use of steam instead of horse power. As the railway was constructed for general use, all who chose might drive their own vehicles upon it; and, as the line possessed but a single pair of rails, with occasional sidings, to allow approaching carriages to pass each other, some very lively scenes were frequently acted upon it, particularly when rival coaches met. Ultimately the company were induced to take the traffic in their own hands, and the benefit of this arrangement was speedily made manifest; for the commercial success of the undertaking soon exceeded the most sanguine expectations of its promoters. The efficiency of the engines employed, coupled with the favorable opinion formed by Mr. Pease of their inventor, induced him, together with a friend, to embark with Stephenson in the establishment of a locomotive engine factory at Newcastle. This step proved to be one of national importance; for a school of practical engineers was there formed, from which skilful workmen were supplied to all parts of the country.

Concurrent with the exertions made to secure a railway between Stockton and Darlington, were the efforts to join Manchester and Liverpool by similar means; the trade between which had quite outstripped the means of conveyance. So early as the year 1821, energetic steps were taken, chiefly at the instance of Mr. William James, then a wealthy and speculative land-agent, of West Bromwich, to effect this object. Being led by business to Liverpool, he found the subject of a tram-road mooted, and taking eagerly to the scheme he commenced a survey of the line. This gentleman, while in the heat of the project, happening to hear of Stephenson's engines, started for Killingworth to inspect them, and became so satisfied with their performance, as to proclaim Stephenson "the greatest practical genius of the age," and bring his name prominently before his Liverpool friends. Slow progress was however made towards the formation of the railway, until the year 1824, when the project was revived, and a company formed to carry it into execution. Mr. Stephenson was invited to make the survey, the plans and surveying apparatus of Mr. James, whose speculations had driven him abroad, being put at his disposal. The opposition offered by the proprietors of the lands through which the railway was intended to pass is graphically told by Mr. Smiles; and the gross imposition practised on the company,

and indeed on railway companies generally, by landed proprietors, during the early years of railroads, is feelingly exposed. After contending against endless obstacles presented to the labours of their surveyors, in doing which both physical force and cunning were frequently called into requisition, on the part of the company, there remained the ordeal of a parliamentary enquiry to be passed. In order to defeat the measure before the committee of the House of Commons, the greatest legal skill was retained by the opponents of the company (the chief of whom were the Duke of Bridgewater's trustees, and the Mersey and Irwell Navigation Company), and the most frivolous and groundless objections were urged, with all the subtlety and eloquence at the command of counsel. The project, it was asserted, was ridiculous, and utterly impracticable. To construct a road across a morass was an unheard of folly; besides which, when made it would ruin existing interests; and then, to drive steam-engines along the road at twelve miles an hour was the dream of a madman; the smoke and noise created thereby would depreciate the property all along the line; the cattle would cease to graze, for fright at the fiery monsters; and the price of coals and iron would rise to a ruinous extent. "For three entire days," says his biographer, "was Mr. Stephenson subjected to cross-examination by Mr. Alderson, Mr. Cullen, and the other leading counsel for the opposition. He held his ground bravely, and defended the plans and estimates with consummate ability and skill; but it was clear they were very imperfect, and the result was, on the whole, damaging to the bill." In their first attempt, as is well known, the company failed to make out their case; but having prepared better plans and estimates, and, what was more important, having bought off a considerable amount of opposition, they succeeded in obtaining, in the following year, the Royal assent to the bill. No time was now lost in pushing on the work. Mr. Stephenson was nominated the engineer, at a salary of £1000 per annum, and the whole construction of the railway was put into his hands. Besides, therefore, planning the way to meet engineering difficulties, he had to organise a system of labor suitable for this new kind of undertaking; and this he succeeded in doing, by embodying that now celebrated corps, known under the designation of "navvies." During the progress of this great work the engineer recalled his son from Central America, to assist him. The directors of the company were in the meanwhile desirous of settling what tractive power should be employed on their line, and not being quite satisfied with the then state of the locomotive engine, they offered a prize of £500 for the best engine; expressing, at the same time, certain conditions as to its build. At the suggestion of Mr. Henry Booth, the secretary to the railway, Stephenson in erecting his competition engine, adopted the tubular boiler, which added very greatly to the power of the engine. At the trial, Mr. Stephenson's engine, the "Rocket," eclipsed its competitors, by attaining "a velocity of twenty-nine miles an hour," or about three times the speed that one of the judges of the competition had declared to be the limit of possibility.

The path before the railway engineer was now smooth; he had effected everything that was required to demonstrate the practicability of railways; and when, in September, 1830, the railway was opened, and the economical success of steam locomotion established, it was merely a foregone conclusion to all those who were capable of forming an impartial judgment on the subject. No sooner were Liverpool and Manchester

brought within an hour's journey of each other, than the *furore* for railways began to spread, and the co-operation of the engineer who had effected so great a triumph in practical science was sought in all direcrions. It would be tedious to trace his subsequent career, as acting or consulting engineer to the several railways that soon spread out their iron arms over the fair fields of England; but it should be remarked that when, owing to the pecuniary success of the earliest railways, the public caught eagerly at the wildest and most impracticable schemes, George Stephenson kept aloof from all which he did not believe would afford a proper return for the capital invested. He thus let pass many opportunities, which, if embraced, would have brought him untold gold; preferring to maintain the character for rectitude, which too many, while the railway fever lasted, were indifferent to secure.

In the year 1832, he became lessee of Clay Cross Colliery, near his residence, Alton Grange, and superintended its working; but in 1837, he changed his residence to Tapton House, near Chesterfield, where he lived for the remainder of his life. Being a man of great energy he could not rest unoccupied. In the year 1841, he therefore erected gigantic lime works, near the Ambergate station of the Midland railway, of which he had been engineer, and carried on the lime burning business with great success, giving only occasional attention to railway projects.

The brakesman of Killingworth colliery had now made himself a name, yet he never forgot or attempted to hide his humble origin; but on all proper occasions urged his own success as a stimulus to others to persevere. The measure which he took of his own powers seems to have been singularly correct, for in his addresses to Mechanics' Institutions, he always maintained that whoever was equally sedulous would be equally successful. He lived to be courted by the great and noble, and in their presence maintained that unobtrusive self-confidence which, in spite of a certain homeliness of speech, stamped him as one of nature's gentlemen. Towards the latter part of his life he devoted his time chiefly to gardening and such like quiet pursuits, and gained no little credit for his skill in this direction. On the 12th August, 1848, he died, in the sixty-seventh year of his age, leaving behind him a name which has been enrolled among the worthies of old England.

RECENT PATENTS.

To George Fergusson Wilson, *of Belmont, Vauxhall, for improvements in treating Burmese and such like petroleum and their products.*—[Dated 12th January, 1857.]

Heretofore Burmese and such like petroleum and their products have been distilled by the aid of ordinary steam, superheated steam, and by fire heat, but the patentee has discovered that such descriptions of petroleum and their products may be more advantageously distilled by the aid of vacuum. The vacuum apparatus he employs is such as is used in boiling sugar in vacuum pans, and to this he applies a refrigerator and receiver between the boiler or still (which is heated by means of a steam coil) and the air pump or vacuum apparatus. When separating the lighter and more volatile products, the refrigerator is surrounded with cold water.

To JOHN ASPINALL, *of Fenchurch-street, for improvements in machinery for extracting moisture from substances, and for separating liquid from solid bodies; applicable to the refining of sugar, drying of goods, and to purposes for which centrifugal machines are employed.*—[Dated 26th May, 1855.]

THIS invention consists in placing a perforated or wire-gauze cylinder or drum, open at both ends, horizontally or in an inclined position; in causing the same to rotate by frictional contact with driving rollers or by strap-pullies, to which motion is communicated from a steam-engine or other prime mover; and in introducing through the centre of this cylinder a perforated pipe, which is stationary, and to which, for some purposes, are fitted a series of inclined directing plates. Or, instead of fixing the inclined directing plates upon the perforated pipe, the invention consists in introducing a fixed shaft or spindle through the centre of the drum or cylinder, and in fixing the inclined directing plates thereon.

The figure in Plate VII., represents a longitudinal section of a machine constructed according to this invention. A, A, is a cylinder of cast-iron or other metal, fixed upon flanges *a, a,* projecting from the inside of the two upright end frames B, B. C, C, is a copper or other suitable metal cylinder, perforated or formed of wire-gauze. This cylinder may be made to increase gradually from the feed entrance to the discharge end thereof, instead of being made cylindrical throughout; it is strengthened by means of the rings *e, e,* and the ends are carried through and project beyond the frames B, B. *f, f,* are flanges round the cylinder, and serving to keep the cylinder always in its place; D, D, are four friction rollers, placed at each end of the machine, and revolving upon the ends of the shafts E, E, fixed in the plummer-blocks F, F. These friction-rollers serve to support the two ends of the cylinder, which are provided with grooved rings *g, g,* in which the friction-rollers work. G, G, are strap-pullies, fixed on the ends of the cylinder, for communicating rotary motion from a steam-engine or other prime mover to the cylinder; H, is a metal cone, fixed to one end of the cylinder at the part where the perforations or wire gauze terminate; and I, is a similar cone, but formed of perforated metal or wire gauze. This cone I, is also fixed to the cylinder, as shewn,—a space being left between the two cones to allow of the escape of the liquid or moisture thrown out by the centrifugal action of the machine. K, is a hopper, for supplying the materials to be subjected to the action of the machine. This hopper feeds in the materials upon the cone portion of the cylinder. L, is a shaft, which passes through the centre of the cylinder; one end of it being supported in the boss of the projecting arms M, M. This shaft serves to support a series of inclined directing plates N, N, placed at suitable distances apart, and fixed to the shaft by the nuts and screws *h, h.* O, is a tube supporting a series of perforated nozzles, through which fine liquor or water, or steam is directed, if desired, upon the materials under treatment in the cylinder.

The mode of operating with this machine is as follows:—Supposing sugar in its semi-fluid state be required to have the liquid separated from the granular matter or particles, and at the same time to be decolored or whitened, it is fed into one end of the drum through the hopper K, while the drum or cylinder C, is at rest or in motion; fine liquor or water, or steam is then introduced through the pipe O. On the cylinder being made

to revolve rapidly, by means of the strap-pullies, the sugar will get massed, or will accumulate for a brief period at the bottom of each directing plate; after which it will be transferred from plate to plate, until it reaches the opposite end of the cylinder, from which it will be ejected into a suitable receiver in a dry granular state, while, at the same time, it will have been deprived, to a great extent, of its coloring matter, and this without stopping any part of the machinery, in order to remove the sugar after being dried and whitened. Q, is a cone fixed to the framework into which the sugar is thrown from the cylinder. This cone prevents the granular particles of the sugar from being scattered. The liquid thrown off from the sugar is received by the outer cylinder, and flows out, through an aperture in the bottom, and down the spout P, into a suitable reservoir or receiver. This machine will be found equally applicable for extracting moisture from other substances, and for separating liquid from solid bodies, for drying goods, and to most purposes for which centrifugal machines are employed.

The patentee claims, "the improved machinery hereinbefore described for extracting moisture and for separating liquid from solid bodies, consisting of a drum placed in a horizontal or in an inclined position, formed and furnished as hereinbefore fully described, whereby sugar and other like substances can be fed into and discharged therefrom dried, and, in the case of sugar, dried and whitened, without stopping any of the parts of the machinery."

To JOHN ASPINALL, *of Limehouse, for improvements in machinery for curing sugar, or extracting moisture therefrom; applicable to separating liquids from solids.*—[Dated 3rd March, 1856.]

THIS invention consists in certain new arrangements of centrifugal machinery, for curing and extracting moisture from sugar, and for separating liquids from solids, and principally in the form of the vessel in which the liquid or moisture is extracted. The improved machinery is made self-feeding and also self-delivering, that is to say, it delivers the sugar (or other substance operated upon) after it has been "cured" or deprived of moisture.

In Plate VII., fig. 1, is a sectional elevation of a machine for curing sugar, constructed according to this invention. A, is an upright shaft, stepped in the casing of the apparatus, and D, is the vessel in which the curing of the sugar or extraction of moisture is effected. This vessel is fixed on the shaft A, and is formed of wire-gauze or perforated metal stretched over ribs, *b*, *b*, following the external configuration of the vessel, and connected at top to a ring B, and at bottom to a disc or circular plate C, shewn in plan in fig. 2. The sides of the vessel D, are formed in steps or gradations D^1, D^2, D^3, D^4, each higher step being of greater diameter than that immediately below it; the steps are formed by flat rings b^1, b^1. E^1, E^2, E^3, E^4, are circular horizontal guide plates, fitted within the curing vessel, resting on blocks or plates on the top of each step or gradation, and forming the vessel, as it were, into compartments. F, is an annular hopper fixed in the frame or casing of the apparatus. This hopper may be allowed to rest on blocks on the top ring of the casing, so as to be easily put in place and removed. The shaft A, passes up through an annular space in the centre of the hopper. The hopper leads, at bottom, into a conical guide

or distributor G, fixed by arms *c*, *c*, to the shaft *a*, and revolving with it. The base of the cone is spread out at bottom, and forms a bell-mouth G^1, the base of which runs parallel with the bottom of the vessel D; but the edge of the base G^1, does not touch the side of the vessel D, a small space *d*, being left between them. Rotary motion having been communicated to the shaft A, (by suitable gearing, actuated by a steam-engine or otherwise), and thence to the vessel D, the sugar falling from the hopper F, drops through the conical distributor G, into the space *d*, and, impelled by the centrifugal action exerted by the revolution of the vessel D, rises from step to step, being forced between the plate E^1, and the part b^1, of the first step, then between the plate E^2, and part b^2, of the next step, and so on successively, until it reaches the top of the machine, when the top plate E^4, directs it out of the machine, and delivers it cured on to a circular platform or other recipient.

In order to facilitate the feeding of the sugar to be cured into the vessel, the machine is placed (when possible) below the pan or heater, so that the sugar may be allowed to fall directly into the hopper through a shute or otherwise.

Fig. 3, is a sectional elevation of a modification of the machine just described, in which the sides of the curing vessel are formed into only two steps instead of four. In this figure the casing of the vessel and arrangement of platform is represented for receiving the cured sugar, which may also be applied to the form of curing vessel shewn in fig. 1. A, is a vertical shaft, revolving in a bearing a^1, in the bottom of a casing B, (set on masonry), and stepped at a^2, in a bracket a^3, attached to the bottom of the casing. C, is the gearing for driving the shaft, actuated by a steam-engine or otherwise. D, is the curing vessel, consisting, as in fig. 1, of wire-gauze stretched over metal ribs *b*, *b*, and connected to top and bottom rings D^1, D^2: the shaft A, in this case does not pass up entirely through the vessel D, which is fixed to it at *e*, and revolves with it. The sides of the vessel are formed in steps, having annular ribs or rings *f*, *f*, extending round the vessel, the circumference of the higher step being greater than that of the step below it. E^1, E^2, are circular guide-plates, fitted horizontally round the inside surface of the vessel D, near the top of each step, but not fixed to the machine, so that they are free to move to a certain extent, as will be presently explained. F, is a stationary hopper, resting at top on a ring f^1, attached to the top of the casing by arms. G, is a conical guide or distributor, fixed on and revolving with the shaft A, and formed with a bell-mouth G^1, precisely as the distributor indicated by the same letters in fig. 1. B^2, is an external casing surrounding the upper part of the casing B, intended to receive the sugar as it is driven from the curing vessel, and to direct it on to a circular revolving table or platform H, which is mounted on friction rollers *g*, *g*, centred on brackets *h*, *h*, fixed on the sides of the casing B. Rotary motion is communicated to this table H, by a strap passing over a pulley J, keyed fast to a shaft *j*, on which one of the friction rollers *g*, is mounted. The sugar, on emerging from the curing vessel, passes through the outer casing B^2, on to the revolving table H, from which it is removed by a scraper K. *k*, *k*, are friction rollers mounted on brackets, affixed to the side of the casing B, for keeping the table at a proper distance from the casing, to prevent it from becoming locked or jammed. On each ring *f*, forming the periphery of each step of the curing vessel, is fixed a bracket *l*, on which is centred a bell-crank

m. One of the arms m^1, of the bell-crank bears against a projection, stud, or rim *n*, formed on the upper side of the plates E^1, E^2; while on the opposite arm m^2, of the bell-crank, is fixed a weight *o*. As the vessel rotates, the sugar falls from the hopper F, through the guide G, to the bottom of the vessel D, and passes up, impelled by the centrifugal action of the machine, until it lodges under the first guide-plate E^1, where it is retained by the weight *o*, and bell-crank *m*, until the weight or pressure of sugar beneath the plate overcomes that of the weight *o*, when the sugar will lift up the plate E^1, and pass up into the compartment between it and the plate E^2, where the same action takes place until the sugar is delivered out of the machine, on to the platform H. The sugar being thus retained for a short time, is more completely cured or deprived of its moisture than it would be if allowed to pass out of the machine without encountering any impediment. The lower plate E^1, is shewn as closed or down, while the upper plate E^2, is represented as lifted up or open, to allow the sugar to pass up.

In the figures the vessels are represented with sides formed into two and four steps, but vessels with sides formed of three or any other number of steps may be adopted.

The improved machinery, it will be understood, is applicable to extracting moisture from other substances than sugar, and also for separating liquids from solids. The vessel which in the foregoing description has been referred to as serving for the curing of sugar, being in these cases the vessel in which the separation of liquids from solids or extraction of moisture is effected.

The patentee claims, "First,—the curing of sugar, extracting moisture from substances, and separating liquids from solids, by causing the substances which are to be operated upon to enter at or near the bottom of a vessel in the form of an inverted cone, with regular or irregular sides or walls, and to be delivered cured or freed from moisture at the mouth or top of the vessel. Second,—the improved construction of vessel for curing and extracting moisture from sugar, and for separating liquids from solids, with its sides arranged stepwise, or formed into gradations, each step being of greater circumference than that immediately below it,—all as hereinbefore described with reference to the drawings annexed. Third,—the particular configuration of curing or extracting vessels hereinbefore described and represented in fig. 1, of the drawings annexed. Fourth,—the construction and method of action of the circular plates or guides for guiding, retaining, and delivering the sugar (or other material acted on), all as hereinbefore described with reference to the drawings annexed. And, lastly,—the general construction, arrangement, combination of parts, and method of action of the machinery for curing sugar, extracting moisture, and separating liquids from solids, all as hereinbefore described and represented in the drawings annexed."

To ALEXANDER WILLIAM WILLIAMSON, *of the London University, Gower-street, for improvements in obtaining the rosin and sugar of scammony.* —[Dated 9th July, 1856.]

THIS invention has for its object improvements in obtaining the rosin and sugar of scammony. Heretofore it has been usual to tap the scammony

roots when growing, and thus to obtain fluid products therefrom. Now this invention consists in grinding or reducing the roots of scammony, and in placing the same in a suitable vessel, and then causing the vapour of alcohol to pass through such reduced or ground roots. The condensed product obtained is evaporated into the consistency of treacle and washed with water, which, being evaporated, leaves the sugar of scammony; and the residue, when washed, contains the rosin, which is heated and dried.

In the figure in Plate VII., *a*, is a retort, the bottom of which is immersed in the bath *b*, containing a concentrated solution of salt, and heated by a fire underneath; and *c*, is a connector which receives the vapour of alcohol as it distils over from the retort. The connector *c*, is made conical at its lower end, so as to fit into the neck formed at the top of the box *d*, which also, at its lower end, fits into the neck of a second and similar box d^1. The boxes *d*, d^1, are furnished with bottoms perforated with fine holes, and are filled with the scammony root, ground or rasped to a powder. As the alcohol vapour passes through the powdered root it becomes condensed, and dissolves out the rosin and sugar which it contains. The lower end of the box d^1, fits into a neck at the top of the standard *e*, which communicates with the serpentine pipe *f*, from the end of which the extract flows. When the liquid flowing from the tube *f*, ceases to be highly colored, the upper box *d*, is removed, and its contents emptied out, the box d^1, is raised to the upper position, and another box containing fresh material is placed underneath it. While the boxes are being changed, the cock *g*, is turned off, and the cocks *h*, and *i*, are opened, to admit the vapour to the condenser *k*. The extract which runs from the tube *f*, is returned to the still *a*, and is there evaporated to the consistence of syrup; it is then mixed with three or four times its bulk of water, which dissolves the sugar, and allows the rosin to sink to the bottom. The solution of sugar is poured off as soon as cold, and will deposit more scammony on standing. The rosin of scammony is dried, and is then in a much purer state than the ordinary scammony of commerce. The sugar may be fermented, to procure alcohol for carrying on the process. By these means the active principle of scammony is obtained in a state of far greater purity and of more uniform quality than hitherto; and a larger product is secured than by the old process of tapping the roots while growing in the earth.

The patentee claims, "extracting the rosin and sugar of scammony, by dissolving them from the roots of the plants after they have been removed from the earth."

To Charles John Lewsey, *of Albion-terrace, Commercial-road East, for improvements in sugar-cane mills.*—[Dated 24th November, 1856.]

This invention for improvements in sugar-cane mills consists in applying, in lieu of the large and massive "side frames" or standards of cast-iron heretofore used, which in practice have been found to be defective in strength and tenacity, wrought-iron standards, composed of numerous plates, so placed and connected together as to present far greater strength than those heretofore used, and at the same time distribute the strain.

In Plate VII., fig. 1, is a side elevation, partly in section, and fig. 2, is an end view, of a cane press arranged according to this invention. *a, a*, is a cast-iron base plate, to which are bolted, by the bolts, a^1, a^1, a^1, the sets

of angle pieces *b*, *b*, made of strong boiler plate, which carry the bearings *c*, *c*, of the two lower rollers. c^1, c^1, are wedges, by which the rollers are set up, as may be required. To the angle pieces *b*, *b*, are bolted tie plates *d*, *d*, which are arranged alternately with the pieces *b*, *b*. At the points where the different sets of tie plates intersect each other the plates of one set pass between the plates of the other set, and they are connected together by bolts. The bearings *e*, *e*, of the top roller are carried in the diamond-formed spaces enclosed by the meeting of the different sets of tie plates, and the lower brass is kept set up by wedges *f*, *f*.

Fig. 3, is an end view of a cane-juice press, with a cane-juice pump, arranged according to this invention, combined with it; and this arrangement is used when the position of the press is such that the juice will not run direct to the boiling room. On the end of the axis of the upper roller an excentric *g*, *g*, is fixed, which gives motion to two bell-crank levers, *h*, *h*, connected with the pump rods *i*, *i*. The juice runs from the bed-plate of the press into the cistern *j*, and is raised therefrom by the pump. The pump has two buckets therein on two separate pump rods. The two buckets are of the ordinary kind, each having its valve. The valves of the two buckets open in the same direction, and they respectively open as they move towards the suction end of the cylinder or barrel, and close as they move towards the delivery end of the cylinder or barrel. *k*, is the suction-pipe, which has no clack or valve; *l*, is the delivery-pipe which conveys the juice away; *m*, is a regulating valve in the pipe *n*. This valve remains closed so long as there is the requisite quantity of juice in the cistern to rise above the lower end of the suction-pipe, but should the level of the juice fall, then the float *o*, will descend and open the valve, the effect of which will be to cause part of the juice to be returned into the cistern, so as to maintain the juice above the suction-pipe; hence all drawing in of air into the pump will be prevented.

The patentee claims, "the combination of the framing and means of applying and adjusting the brasses or bearings therein; and also the combining with sugar mills, pumps, arranged without clacks or valves to the suction pipes, as herein described."

To Richard Archibald Brooman, *of Fleet-street, for improvements in treating beetroot and other saccharine vegetable substances, in order to extract alcohol therefrom, and at the same time render or leave the remaining parts of the vegetable fit food for cattle,—being a communication.* —[Dated 24th December, 1855.]

This invention has for its object the treatment of beetroot, carrots, turnips, and all other suitable saccharine vegetable substances, in such manner as to extract alcohol therefrom, and render the remaining parts of the vegetable fit and nutritious food for cattle; the alcohol obtained being a marketable product, and the food possessing the most advantageous properties for the purpose for which it is intended.

The invention consists in causing the sugar contained in the vegetable matter to ferment in the cells of the beetroot or other vegetable, and in distilling the substances (cut up into pieces) by direct distillation, by means of a current of steam made to pass up and circulate among the pieces of vegetable. The vegetable substances retain all their nutritious portions, the sugar only being removed by fermentation and distillation. The vege-

table is first cut up into pieces or strips, of such shape as that, when piled one on the other, spaces may be left between them for the circulation of the steam. The pieces are then immersed in fermented juice or liquid, and a certain proportion of sulphuric, hydrochloric, nitric, tartaric, or other powerful acid is added. The fermentation that ensues changes the sugar of the vegetable into alcohol, which is next distilled out by means of apparatus in which the distillation is carried on as follows:—The pieces of vegetable are placed in layers one above the other on perforated diaphragms, in a vessel into which a current of steam is introduced. The steam circulates between and among the pieces, heats them through, and expels the alcohol therefrom, which ascends among the layers of vegetable in a state of vapour, gathering alcoholic strength as it rises. A number of vessels containing layers of vegetable may be placed one over the other, and the vapour allowed to pass up through them to increase its alcoholic strength. The alcoholic vapours pass away through a refrigerating coil or vessel, leaving the vegetable substances cooked, and in a state ready to be employed as food for cattle. After this process the pieces of fermented vegetable substance retain their form, and are left to drain or discharge their moisture, whereby they are reduced in bulk; but the nutritious matter contained in them becomes concentrated, so that hardly any of it is lost. The pieces may be piled up in thick layers in a drained or porous field or ditch, in the open air, where they form a compact mass, which may be preserved for a length of time without the addition of any preserving ingredient, and even without being covered over with earth.

In Plate VII., fig. 1, is a sectional elevation of a fermenting vat or vessel of the improved description. A, is the body of the vat; B, steam-pipe for heating the liquid; and F, the cover. Care should be taken to maintain a proper proportion between the weight of the pieces and the quantity of juice. The inventor has found the following a satisfactory proportion in a vat of the capacity of, say, from 1,150 to 1,200 gallons:—3,330 lbs. beetroot to 660 gallons fermented juice. The pieces of beetroot are first placed in receivers, made of iron, wood, or other material, and then transferred to the fermenting vessels. When the pieces are being immersed in the fermented juice, a certain quantity of sulphuric, hydrochloric, tartaric, or other powerful acid is added. The quantity of acid should be regulated according to the nature of the root and the soil in which it is grown. For example, beetroot grown in calcareous soils requires a greater quantity of acid. It also depends on the cleanliness of the root and the season of the year; as, for example (in France), beetroot cultivated in March requires less acid than that cultivated in November. Too weak a dose of acid would produce scum, and the liberation of carbonic acid would continue for a long time after the frothy fermentation subsides; while on the other hand too strong a dose of acid would retard the fermenting process, and sometimes completely prevent it. The proper quantity of acid is that which would produce the most rapid fermentation: $3\frac{1}{2}$ pints sulphuric acid at 66° is an average proportion to 2,200 lbs. beetroot. The acid may be put in in three several times; that is to say, when a third of the pieces have been put in, add a third of the acid, and so on. The acid should be previously diluted with water or fermented liquid, in the proportion of $\frac{1}{10}$ acid to $\frac{9}{10}$ liquid, so as to prevent the action of the concentrated acid on the pieces of beetroot, and the mass should be well stirred, so that the acid may be intimately mixed up with the liquid. The temperature of the

mixture should be from 77° to 82° Fahr.; a higher temperature would be injurious. In order to counteract the cooling produced by the mixture of the pieces of beetroot with the acid (the former being of lower temperature), a small quantity of steam should be admitted, so as to keep up the temperature while charging the vats; and the mixture should be stirred while being heated, or otherwise the temperature would not be uniformly diffused, and would be too high at certain points.

To leaven the mass, about 11 lbs., more or less, of beer yeast, or 17 pints of liquid yeast, are mixed with a small quantity of juice from the same vat, until the mixture gets well amalgamated, and the whole is then thrown in the vat, and well stirred. The vat should be filled up until the contents reach the brackets *a*, *a*, on which the lid rests, which would be about, say, 8 inches from the top edge of the vat, and keeps the pieces of beetroot submerged in the fermented liquid. The lid should be made in two parts, and formed of pieces of wood, perforated and placed a short distance apart, and the cover fixed by cross pieces; were it not for this, the carbonic gas disengaged during fermentation would force some of the pieces of beetroot out of the fermented liquid, and in those pieces fermentation would not ensue. Fermentation rapidly takes place in the vat thus charged; the liquid rises through the holes, boils up, and the carbonic gas becomes disengaged rapidly. When the fermentation is terminated (say, in from 12 to 20 hours), ebullition ceases, and the liquid subsides to the volume it previously had. To empty the vats, the bars which fix the cover down must be removed, and half the cover taken off; the pieces of beetroot lie massed together on the top of the liquid in a thick layer; they are removed with a stoop, and transferred to a wicker basket or perforated iron vessel, and allowed to drain.

The second replenishing or charging of the vats is effected precisely as before, and with the same proportions of acid, but the quantity of yeast reduced to, say, 2¼ lbs.; in the subsequent replenishing it may be entirely dispensed with. When the steam employed to prevent the diminution of the temperature from the consecutive charging with beetroot becomes condensed, there results an excess of liquid, which should be distilled from time to time in the distilling apparatus; the juice should be put into a cylinder, but so as only half to fill it. The fermentation being thus effected, the saccharine matter becomes completely transformed into alcohol, the quantity of which is always proportioned to the saccharine richness of the beetroot. If, in 24 hours, fermentation does not declare itself, and the temperature does not exceed 87° Fahr., it is a sign there is too much acid. To bring about fermentation, the pieces of vegetable are taken out of the vat, and transferred to another, in which only half the usual dose of acid is put, and 2 lbs. yeast added, and in the other vat the same quantity of vegetable added, half the usual dose of acid, and 2 lbs. yeast. If fermentation does not ensue because the temperature of the composition during the heating of the vat is too high, the beetroot should be removed, and placed in an empty vat, with half the usual dose of acid and 2¼ lbs. yeast. If the distilling operation should have to be stopped, the beetroot should be kept in the fermenting vats, which is necessary for the due fermentation of the liquid, and vats may thus be kept for several weeks without any mischief arising. On resuming the process of distillation, the pieces are removed, the vat refilled as usual, and 2¼ lbs. yeast added, and the fermentation thus completed. If the liquid should be removed

from the pieces of vegetable in 48 hours, they would be covered with scum, and would pass rapidly into a state of acetic and putrid fermentation; therefore the vats, when emptied, should be filled again as soon as possible, and a vat should not be left only partially filled for a whole night. If, on commencing the operation, there is no fermenting liquid at hand, two parts of common water may be employed, and the pieces of beetroot and sulphuric acid are added. When the vats are filled, the mixture is stirred, and left to macerate for about four hours, after which about 21 or 22 lbs. of yeast are added, and the operation proceeded with as before. The first distillation only produces weak alcoholic product, and it is not until the liquid in the vat is saturated with alcohol that the alcoholic yield is equal to the quantity of sugar. To extract the alcohol from the fermented vegetable substances a current of steam is passed through the pieces, as before stated.

The distilling apparatus consists of cylinders of the description represented in elevation in fig. 2, and in plan at fig. 3. The cylinders are here shewn as three in number, but a greater or less number may be employed. A^1, A^2, A^3, are the cylinders, which communicate with each other by pipes D, D^1, D^2, whereof the pipe D, passes from the top of the first cylinder to the bottom of the second, the pipe D^1, from the top of the second to the bottom of the third, and the pipe D^2, from the top of the third to the bottom of the first cylinder, so that there may be an uninterrupted circulation; each cylinder is, moreover, in communication with a pipe K, which leads to a refrigerator, and with the main steam-pipe C, communicating with the steam-boiler. E, E, are branch-pipes; G, G, discharge cocks. The pipes are furnished with cocks, so arranged, that communication may be shut and opened either between the cylinders among each other (by the cocks L,) or between the cylinders and the refrigerator (by the cocks O, O,) or between the cylinders and the steam-boiler (by the cocks H, H). Each cylinder is provided with a moveable cover P, which fits into a groove, and is fastened down by screws P^1, P^1, and provided with an india-rubber washer or hemp packing. In each cylinder are from ten to thirteen diaphragms Q, Q, Q, about eight inches apart (more or less): there should not be too great a distance between them, as the current of steam could not circulate through thicker layers of beetroot. A rod R, is fixed to the bottom of each cylinder, or to the middle of the lowermost diaphragm in each, and passes up through the centre of the diaphragms, in each of which is an orifice about $\frac{3}{4}$ inch across, with a collar *r*, to receive the rod. The distance between the lowermost diaphragm and the bottom of the cylinder may be about $\frac{1}{5}$th or $\frac{1}{6}$th of the height of the cylinder, and the waters of condensation formed during the distillation fall into the space between the lowest diaphragm and the bottom of the cylinder. These waters of condensation retain a small amount of alcohol, which is liberated by passing steam through a pipe perforated with holes, through which the steam escapes. Each cylinder has a large tap, through which the waters of condensation flow out; this tap should be above the perforated pipe, so that a little liquid may be left at the bottom of the cylinder, and the steam may thus always escape into liquid. This arrangement prevents the steam from coming with too much force amongst the pieces of beetroot, and from passing too quickly among a portion of their contents. The cylinder A^1, is shewn partly in section; and the rod R, is represented with the diaphragms Q, on it. The cylinders are filled and emptied dia-

phragm by diaphragm. On the lid of each cylinder is a safety-valve, balanced at a pressure of one atmosphere; there should also be a valve in the double bottom a little above the first diaphragm. The contents of a cylinder should be about equal to that of a fermenting vat.

The inventor has found that an apparatus for distilling about 65,000 lbs. in 24 hours should be about 3½ yards in diameter, 9 feet high, and should have twelve diaphragms. For distilling 32,500 lbs., a rather less diameter would suffice, and about 2½ yards height, with ten diaphragms. To fill the cylinders, the first diaphragm Q, is passed down the rod R, and lowered a little way, where it is kept suspended by a double hook, attached to a rod terminating in a ring, through which a cord passes, which is carried over a pulley or pulleys, raised and worked by a crab W. The hook holds the diaphragm by catching into lugs on the central collar *r*. The pulpy vegetable matter is poured on to this diaphragm, and spread evenly over its surface by hand, with a fork or otherwise. The diaphragm is turned on its axis to receive another supply of beetroot, care being taken to leave no space in which the steam may have too free a vent; the diaphragm is then lowered to its proper place, by slackening the cord gently. The pieces must be spread evenly if disturbed in the descent, and massed up against the sides of the cylinder, so as to leave no space there for the steam to get through: the other diaphragms are then filled and lowered in place in a similar manner. When all the diaphragms are filled, the orifice through which the alcoholic vapours are to escape is cleared from the pieces of beetroot that may happen to cover it. The cover is then lowered in place, with the hook and crab, and screwed down. The cock in the pipe K, is then turned, to open communication with the refrigerating apparatus. The direct steam-tap in the pipe D^2, is next opened, and steam begins after a time to pass into the refrigerator. The scums then begin to flow into the gauge, first at a temperature of from 176° to 158° Fahr., and as the action of the steam continues for three-quarters of an hour, the temperature of the scum diminishes gradually till it reaches 86° Fahr. While distillation is going on in the first cylinder, the second cylinder is being filled with fermented beetroot. When the scums from the first cylinder are at a temperature of from 77° to 86° Fahr., the tap which effects communication between the top of the first cylinder and the bottom of the second cylinder is opened, and the tap which effects communication between the second cylinder and the refrigerator is also opened, while a tap is closed, to shut off communication between the first cylinder and the refrigerator. The first and second cylinders are thus in communication, and the steam continues to circulate through all the layers of the beetroot up to the top of the second cylinder in about three-quarters of an hour; the alcoholic vapours in the second cylinder then pass into the serpentine coil of the refrigerator, and give forth scum as in the first cylinder. The steam should be so regulated that the distillation should go on for about three-quarters of an hour. While the distillation is proceeding in this cylinder, the third cylinder is being filled; the cock which effects communication between the top of the third cylinder and the refrigerator, and the cock between the top of the second cylinder and bottom of the third cylinder are opened; and the tap which communicates between the top of the first cylinder and bottom of the second cylinder is closed. The tap between the top of the second cylinder and the refrigerator is shut, as also the direct steam tap on the pipe which connects the top of the third cylinder and the bottom

of the first cylinder: the tap on the pipe which connects the top of the first cylinder to the bottom of the second cylinder is opened. The top of the second cylinder is now in communication with the bottom of the third cylinder. Steam is admitted into the bottom of the second cylinder from the generator, and circulates through the layers of beetroot on the diaphragms, and expels the alcohol, which escapes in a state of vapour into the top of the third cylinder, circulates through all the layers of beetroot, gathering strength as it proceeds, and then disperses in the refrigerators in a state of scum, just as during the distilling process in the second cylinder. During this time the first cylinder is insulated. The cover is then to be taken off, and the diaphragms taken out one by one, by attaching the hook suspended to the cord over the cylinders into the lugs on the central collars of the diaphragms. When the scum from the third cylinder is at 86°, communication should be opened between the refrigerator and the third and first cylinders; the second cylinder is then insulated, emptied, and refilled. During the distilling operation there is always one cylinder insulated, and being emptied; while there are two in communication, one of which is being heated and distilling, while the other is exhausted; the other being exhausted in its turn, and so on.

The patentee claims, "First,—the method of, and machinery for, preparing food for cattle from beetroot and other saccharine vegetable substances, by reducing them to pieces, and by subjecting them to fermentation and distillation, as hereinbefore described. Second,—the improvements in treating beetroot and other saccharine vegetable substances, hereinbefore described and represented, so as to extract alcohol therefrom, and to leave the remaining part fit food for cattle."

To CONRAD WILLIAM FINZEL, *of Bristol,* WILLIAM NEEDHAM, *of Smallbury Green, Middlesex, and* JOHN BARTON, *of Shoe-lane, for improvements in apparatus for filtering sugar and saccharine juices.*—[Dated 8th May, 1856.]

THIS invention consists in the adaptation to the filtration of sugar and saccharine juices of certain apparatus, for which letters patent were granted to William Needham and James Kite, July 14th, 1853. The essential feature of the aforesaid apparatus is the combination of straining or filtering cloths or other textile fabrics with grooved slabs or planks, in such manner that, while the slabs or planks receive and resist the pressure to which the fluids or semi-fluids are subjected, in order to strain or filter them, the grooves form passages or channels by which the expressed and filtered fluids pass away to suitable receivers or otherwise. The cloths or other textile fabrics employed are each turned over and folded down around their edges, so that they form for the time bags or chambers, into which the fluid or semi-fluid enters by a pipe: at one point the folds at their edges are so arranged that the internal pressure of the fluid has no tendency to separate the edges, but, on the contrary, tends to tighten the folds. The object of this arrangement is to prevent the fluid operated upon from escaping in any other way than through the substance of the cloth or other fabric, and at the same time to leave the cloth or other fabric unjoined at its edges, so that, after the operation, it may be opened out to facilitate the removal of the solid substances remaining in it. Two

grooved slabs or planks and one cloth form one filtering chamber, and by placing additional slabs or planks above or below the first, or side by side with them, or otherwise in connection therewith, any number of such filtering chambers may be formed,—the whole being supported by any suitable framework calculated to sustain the pressure to which the fluids to be filtered will be subjected.

This apparatus it is now proposed to adapt to the filtration of sugar and saccharine juices by employing a series of chambers formed as above described, and, in some cases, placing within each chamber a loose grooved slab or plank, with filtering medium on each side of the slab, the object of which is to assist in compressing the substance remaining in the cloth or cloths. This effect is obtained by shutting off the connection between the supply pipe and that chamber (by means of a stop-cock with which each supply pipe is provided or otherwise), and by allowing the pressure to be continued in the chamber above or below it, or in both; the effect being to force the juice out of the said chamber, and to press the loose slab or plank against the substance or substances remaining in the cloth or other fabric on the opposite side of the floating slab, whereby the expression of the juice from it to the greatest possible extent will be obtained. This arrangement may be said to be double acting. In order to clear the substance or substances which the cloths or other fabrics retain, as far as possible, from saccharine matter, and to cleanse them, should they become choked during the filtration, steam or hot water is passed through them by means of suitable pipes, before the chamber is opened, and the remaining substance or substances are removed from it. The supply pipes of all the several chambers may join one larger supply pipe, and the juices are forced through this either by a force pump, the pressure of a column or head of the liquid, or otherwise.

The patentees claim, "the adaptation to the filtering of sugar and saccharine juices of the aforesaid apparatus, patented by William Needham and James Kite, by the means and in the manner hereinbefore described."

To Charles Garton *and* James St. John Gage Parsons, *both of Bristol, for a method of treating cane sugar in order to fit it to be employed in brewing and distilling.*—[Dated 21st November, 1856.]

This invention consists in increasing the fermentable properties of cane sugar, prior to its being employed in brewing or distilling, by treating it in the following manner:—Water is mixed with the sugar, to liquify it, and acid is added thereto; the solution is then exposed for about five days, more or less, to a temperature of about 150 Fahrenheit, and the acid is subsequently neutralized by chalk or other suitable agent. The sulphate of lime is separated from the saccharine solution thus obtained by allowing it to precipitate, or by filtration, when it will be ready for use; or it may be evaporated and granulated as found desirable.

In carrying out this invention, to each hundred-weight of cane sugar dissolved in water (to form a syrup of the gravity of from 30° to 33° Beaumé,) from one to two pounds of sulphuric acid, 184 gravity, is added, and the solution is maintained at a temperature of from 130° to 180° Fahr., for a period varying from 48 to 96 hours; at the expiration of which time the desired change in the composition and properties of the

sugar are effected. By using a larger quantity of acid with a lower temperature, or exposing it for a shorter period to the action of heat, the same results are obtained; but should it be desirable to effect the change in a shorter period than the time above specified, a larger quantity of acid must be used, or the mixture must be exposed to a higher temperature, or both means should be combined; care, however, must be taken in the last case, not to char the sugar. The change will be known to have been perfected by the use of the polariscope,—the primitive rotation from left to right being changed from right to left. The change, however, should never be carried so far as to shew a higher rotating power than from 12 to 15 by the index of the polariscope.

When it is desired to decolorize, the syrup is passed in the usual way through animal charcoal or other suitable decolorizing agent. Should any excess of lime remain after neutralizing the sulphuric acid, it can be separated from the syrup by the aid of any acid which forms an insoluble compound with lime, as tartaric acid.

If the syrup is intended to be used in the brewing of wines, or of vinegar, either citric or tartaric acid is added, or the bitartrate of potash, in considerable excess.

The patentees claim, "the treatment of cane sugar, in order to fit it to be employed in brewing or distilling, by the means and in manner hereinbefore described."

To William Johnson, *of Lincoln's-inn-fields, for improvements in the treatment, preparation, or manufacture of sheet caoutchouc, and in the combination thereof with cloth and other fabrics,—being a communication.*—[Dated 3rd October, 1856.]

This invention relates to a mode of preparing sheets of caoutchouc, and combining them firmly with cloth and other fabrics, to produce either elastic or inelastic goods for the manufacture of shoes, and other articles in which various degrees of elasticity are desirable.

In carrying out this invention, sheets of vulcanized caoutchouc are first desulphurized on their surfaces, by boiling the sheets in caustic alkali, and afterwards in salt pickle, to neutralize the alkali remaining on the sheet, and then washed. These sheets are next to be ground or roughed on their surfaces.

In Plate VIII., fig 1., represents a side or end elevation of the machinery employed for grinding or buffing the surface or surfaces of the sheets of caoutchouc. *a*, is an open timber frame, supported on suitable standards or supports *b*, and carrying at its lower end a roller *c*, upon which the sheet *a**, to be buffed is wound. This sheet passes from the roller *c*, over a pair of carrier rollers *d*, and thence over and partially round the stretcher-bar or temple *e*, shewn more clearly in the detail plan, fig. 2. The rollers *c*, and *d*, and the stretcher-bar *e*, are carried by a frame or holder *f*, such frame being supported by the studs *g*, which rest upon the main framing *a*, so as to enable the bar *e*, to be raised or lowered as required. The surface of the stretcher-bar is grooved in opposite directions from the centre, as shewn in fig. 2, so that as the sheet is drawn over it, the reverse angular grooving of the bar will keep it perfectly well stretched or distended breadthwise. From the stretcher-bar *e*, the sheet passes below the grinding or buffing cylinder g^1, the surface of which is coated or

covered with emery, sand-paper, or other suitable grinding material. The sheet then passes over the drawing cylinder *h*, and is finally wound on to the receiving roller-beam *i*; but between the buffing cylinder and the drawing cylinder, its roughened or buffed surface is subjected to the action of the circular brush *k*, which removes any loose fragments and dust or dirt from the surface of the sheet. *l*, is the main driving-shaft, fitted with the fast and loose driving-pulleys at *m*. The grinding or buffing cylinder g^1, is driven by the belt *n*, from the large pulley *o*, fast on the driving shaft. *p*, is an intermediate shaft, which carries a cone drum *q*, and receives motion, by means of the belt *r*, from another cone drum fast on the driving-shaft. A slow motion is transmitted from the shaft *p*, by means of the belt *s*, to the stud pulley *t*, which carries a small pinion *u*, gearing into the spur wheel *v*, fast on the axis of the drawing cylinder *h*. This cylinder will obviously revolve at a very slow rate, and by the adhesion of the sheet of caoutchouc to its surface (the receiving cylinder beam *i*, resting thereon), the sheet will be drawn slowly through the machine and round on to the beam *i*, which rotates by surface contact with the drawing cylinder. The grinding or buffing cylinder g^1, rotates in a contrary direction to that of the motion of the sheet, and revolves at a high velocity, say, about from eight hundred to one thousand revolutions per minute, whilst the sheet is slowly traversed beneath it. The motion of the sheet may be regulated by suitably shifting the belt *r*, along its cone drums. The rotatory brush *k*, is driven from the second large pulley *w*, on the main driving-shaft, by means of the belt *x*, and revolves in the same direction as the buffing cylinder. By fitting the stretcher-bar *e*, in an independent oscillating frame, it may be raised or lowered, so as to bring a greater or less surface of the sheet in contact with the buffing cylinder. The frame may either be adjusted and fixed in any desired position by screws or other suitable contrivance.

The fabric to be attached to the sheet of caoutchouc is coated on the surface to be united with a thin layer of dissolved caoutchouc, the solvent employed being subsequently thoroughly evaporated from the solution. The fabric or fabrics thus prepared is or are to be brought into contact with the previously prepared sheet of caoutchouc by being subjected to a strong pressure between a pair of heavy rollers or otherwise, the united surfaces being made to adhere firmly together without the application of cement to the caoutchouc.

Fig. 3, represents a longitudinal vertical section of a machine for uniting the fabrics and sheet of caoutchouc. a^*, is the sheet of prepared caoutchouc, and b^*, are the two lengths of fabric which are to be united therewith. The caoutchouc is contained on the beam *i*, which corresponds to the receiving beam *i*, of the buffing machine hereinbefore described; this beam when full being transferred to the uniting machine. *b*, *b*, are the beams which carry the fabrics,—a proper drag or tension being imparted to the cloth by any convenient arrangement of friction apparatus applied to the beams. *c*, *d*, are heavy pressing rollers for uniting or pressing together the three webs or sheets a^*, b^*, b^*; and *e*, *f*, are two other rollers revolving in the same direction as the lower pressing roller *d*. These four rollers *c*, *d*, and *e*, *f*, are all driven by a positive motion, by any convenient arrangement of gearing. The roller *i*, rests obliquely or upon one side of the roller *e*, and receives motion therefrom by frictional contact merely. The upper surfaces of the two rollers *e*, and *f*, and the

point of junction or contact between the two pressing rollers, should all be in one straight line, in order that the three fabrics may be simultaneously united at one point, such point being the point of contact between the pressing rollers. The combined fabricis carried forward, and wound on to the receiving beam *g*, which rests upon the roller *f*. If it be required that the combined fabric should be elastic or extensible, the roller *e*, should be driven at a slower rate than the rollers *d*, and *f*, the surface speed of the two latter, however, being always equal; it then follows that the sheet or web of caoutchouc a^*, will be united to the upper and under fabrics b^*, in an extended state, as the caoutchouc will be drawn out quicker than it is delivered,—the amount of extension depending on the relative speeds of the roller *e*, and the two rollers *d*, and *f*. The combined fabric, on being released, will shrink to the original dimensions of the caoutchouc before being stretched or distended, and it can be stretched or distended again to the original dimensions of the cloth, the combined fabric being perfectly elastic within these limits.

For an elastic fabric, cloth of an open thin texture is the best, as it is more easily shrunk than a closely woven cloth, which would wrinkle or pucker when subjected to the contraction of the caoutchouc. After the combined fabric has been thus manufactured, it should be subjected to a temperature of from one hundred and fifty degrees to two hundred degrees Fahr., in order to secure the adhesion of the parts, and to evaporate and destroy any exhalations or offensive smells arising therefrom.

From the combined fabric produced by this improved method, shoes, gaiters, bootees, boots, suspenders, belts, garments, and the various articles to which it is applicable, may be formed in the usual manner of construction; or the caoutchouc and cloth may be united while in the process of construction, so as to allow extensibility and elasticity where desired, and an absence of this quality where not wanted; and the article so constructed may be seamless, and impervious to water. The process of construction is as follows:—A model is first formed of the required form and dimensions for the article to be constructed; on this model a covering of vulcanized caoutchouc is laid, and so connected, by cementing its edges and joining where necessary, as to make a perfect covering of the model in a thin sheet of caoutchouc. Another model is then prepared, of such size and form as is required to allow proper degrees of extension in every part where necessary, in the extreme enlargement required in the article to be produced. This enlarged model is then covered with cloth, being also fashioned into a garment by joining its edges, where necessary, either by sewing the same, or by cement, and having its interior surface covered with a thin coating of caoutchouc, as previously described, when applied to plain sheets or webs. The caoutchouc covering on the first model must then be buffed on both sides, if it has not been previously passed through that operation before being formed into shape. For this purpose the buffing or grinding can usually be better done by a belt covered with emery, especially if the form is irregular, as in the formation of a shoe. The article to be buffed may be held by hand in contact with the buffing-belt, cylinder, or other revolving form, if necessary. When thus prepared, it is drawn over the larger model, so as to cover the cloth form, and while in this condition another cloth form, coated thinly on its contact side with caoutchouc, as in the former covering, is placed over the

whole, the joints or seams of which may be closed or secured by sewing or cementing; after which every part of the article should be subjected to pressure sufficient to ensure perfect contact of the surfaces whilst on the model; it may then be subjected to moderate heat to perfect its adhesion and to evaporate any exhaling odours, and the combination is complete. When the article thus constructed is removed from the model on which the cloth formation was effected, it will contract nearly to the proper dimensions of the caoutchouc, or the model on which it was formed, and may be again drawn out or extended in any of its parts, to correspond with the dimensions of similar parts on the model of the cloth formation, or can be extended in any of its parts from the proper dimensions of the caoutchouc to that of the cloth formation, and is elastic between these limits. If the article to be constructed be a boot or shoe, a sole may be attached by the usual known methods, and so as to cover most of the seams or joinings of the external covering. In this manner a seamless shoe is constructed, and one impervious to water, and which is extensible and elastic where necessary, and inextensible where not so required; thus shoes, gaiters, bootees, and boots may be made to fit close around the top of the foot and ancle, and yet be susceptible of being drawn with ease over the largest part of the foot. In this manner may also be constructed any seamless garment, possessing extensible and elastic properties where required, and inextensible where not so required. When much extension is requisite, the caoutchouc formation should be made somewhat smaller than the required size, for otherwise its contractile force will not be sufficient to reduce an extended cloth formation quite to the proper limits of the caoutchouc; but if the cloth is of an open and thin texture it will approximate thereto. Instead of applying a caoutchouc form between two cloth forms, it may be applied to one cloth form with like results, and in this way may be constructed caoutchouc shoes lined with cloth only, so as to be extensible and elastic,—the cloth serving to preserve their strength during extreme tension.

For the construction of suspenders, belts, and any textile articles of uniform width requiring elastic properties, the cloth forms may be woven in two folds or thicknesses in the manner of weaving seamless bags, and a thin strip of properly prepared caoutchouc, in an extended state, is applied within and through the form,—the whole being pressed between rollers to secure permanent adhesion of the caoutchouc and cloth. The article so constructed will contract to the natural dimensions of the caoutchouc, and may be again drawn out or extended to the proper dimensions of the woven fabric, and is elastic to that extent. The woven fabric may be produced in an ordinary loom, and several forms or widths may be produced simultaneously on a loom of corresponding width; it is only necessary that between each form or proper width for one belt or suspender the weft shall interlock with the whole warp, uniting it in a single fold or thickness, and in a manner well known and practised in weaving seamless bags.

These forms, when woven, may be divided by cutting along the centre of the united folds *a*, and when separated, each forms a perfect bag or case with fringed ends. This bag is then coated on the outside with a solution of caoutchouc, as before described; it is then reversed or turned inside out, so as to bring the fringed edges within, and a strip of vulcanized caoutchouc, prepared as before described, by buffing its surface, is inserted;

and while in an extended state it is passed between pressing rollers, to secure its combination with the cloth form. The woven fabric may be wrought in any style, pattern, or colors which fancy may dictate, and the common appendages of end straps, buckles, &c., may be connected thereto either after the materials are combined, as described, or they may be inserted in each end, and connected by cement or otherwise between the caoutchouc and cloth. Instead of applying the caoutchouc to the cloth with a uniform tension, it may be extended in a greater degree near the extremities than in other places, and the article produced will possess greater extensible and elastic properties near the ends.

The patentee claims, "First,—the general system or mode of treating sheet caoutchouc and combining it with woven fabrics, as hereinbefore described. Second,—the grinding or buffing of the surface or surfaces of a sheet of vulcanized caoutchouc by passing it in contact with a revolving cylinder, or other revolving form or detail, covered with emery, sand-paper, rasps, files, or any other material or article giving it a rough grinding surface, for the purpose of destroying the glazed or glossy surface of the caoutchouc, and giving it a fine velvety fibrous texture, by which means its union to cloth can be effected without depositing cement on its surface. Third,—the application of a sheet of caoutchouc, prepared by buffing its surface, substantially as described, to a single piece or between two pieces of cloth, previously prepared by being thinly coated with caoutchouc, subsequently evaporated to dryness on the contact sides; such sheet of caoutchouc being either in an extended state to produce an extensible and elastic fabric, or in a free state to produce an unelastic fabric. Fourth,—the construction of elastic or partially elastic shoes, gaiters, bootees, boots, garments of various kinds, and suspenders, as hereinbefore described."

To FERDINAND POTTS, *of Birmingham, for certain improvements in tags for stay and other laces, as also in the machinery for forming and finishing the same.*—[Dated 23rd July, 1856.]

THIS invention relates to the mode of forming, applying, and finishing tags of laces for stays, boots, and other uses.

In Plate VIII., fig. 1, is a sectional elevation of a tool employed by the patentee in carrying out his invention, and used in conjunction with Knight's patent press. E, is a bolster to be held by the set pins on the bed of the press; and F, is what is called the bed tool secured to the same. G, is the top tool, secured to the guide-rod by the pin H. The tags are applied to the material of which the lace is composed in double lengths, and two double tags are applied at one time, as will be understood hereafter from the description of the tools. The braid or cord of which the laces are composed, is usually woven or braided in long lengths, and wound upon reels. When two double tags are applied at a time, two reels, charged with the material intended to be tagged, are employed, and these reels are placed in any situation convenient for drawing off the braid, which, before passing through the hollows *i*, *i*, of the bed tool F, fig. 1, is conducted through a guide-hole, which makes it tight and round for receiving the tag, which is applied in the following manner:—Take a suitable piece of tin or thin sheet-metal, of the required length and width, as represented in plan view at fig. 2, and end view at fig. 3; the form represented in the

end view being given to it at the time of cutting out, or by a subsequent operation with suitable tools. This tag-blank is represented on the left-hand side of the bed tool F, as ready for receiving the lace; and supposing another tag-blank and lace were on the other side of the tool, the top tool G, may be made to descend, and in its descent the tag-blanks would take the circular form of the groove *i*, in the bed tool, coiling round like a scroll, holding the lace in its centre. Great attention must be paid that the width of the tag-blank, the bulk or size of the lace to be encompassed, and the size of the circular grooves *i*, *i*, are in unison with each other, for it is evident that the diameter of the tag will depend upon the size of the circular groove on which it depends for its form; therefore, the bed tool must be altered according to the size of the tag and braid to which it is to be applied.

The next improvement in tags is to form around them a series of indented grooves, which will have a somewhat analagous effect to that imparted to sheet-iron by corrugating it, which gives it great rigidity in the direction of the corrugations. The common defect of the ordinary tags on laces is their great liability to pull off with ordinary use, and the reason of their doing so is in consequence of the thinness of the metal of which they are composed springing apart at any slight internal pressure; this tendency is entirely remedied by the additional lateral strength imparted to the tags by the grooves above referred to. A double tag of this description is shewn at fig. 4. The dotted line *k*, *k*, shows where the tag is to be divided, thus leaving a part attached to the lace on either side. These circular grooves may be formed in various ways; but the following plan is arranged that they may be formed by the same description of tools and press as hereinbefore described. The top part of the bed tool F, that works up in the corresponding groove in the top tool G, is made applicable to this purpose, having a semicircular groove formed from front to back, as shewn at *l*, and, in a plan view of the same part, at *l*, *l*, fig. 5.; and on this part of the bed tool a series of slots or cuts are formed at right-angles to the groove *l*, in which small pieces of steel are inserted, marked *m*, *m*, the thickness of the steel being the same thickness as the groove; these bits of steel are cut out with a small semicircular indentation, so placed that it shall be concentric with the semicircular groove *l*, *l*; and round this small semicircular indentation the edges are to be filed off, so as to make the bits of steel at this part smooth and somewhat thinner, so as to give the proper indentation. These bits of steel are retained in the bed tool by two angular pins passing in through an angular groove running from front to back, of the form shewn in the end view at *n*, *n*, fig. 1. The counter-tool to this is formed in the same way, and is represented in a side, end, and bottom view at fig. 6.; this part being fitted to the top tool G, by a square pin passing through a square groove,—one half being shewn at *p*, *p*, on the top tool G, fig. 1., and the other half in the end view at *r*, *r*, fig. 6., which will also have the effect of holding in the bits of steel in the same way in which they are retained in the lower tool, and which bits of steel are identically the same shape in each tool, for the convenience of renewal when worn out or damaged. The patentee remarks, that when the tools are arranged for performing this operation, the applying of the tags is discontinued, as the arrangement of the tools, as here exhibited, will not allow the two operations, namely, the applying and finishing of the tag, to be done at the same time. The lace, with the tag on it, is brought

through from the back, and laid in the groove *l, l*, fig. 5., when the corresponding top-tool is brought down upon it by the foot pressing on the treadle, and the indentations formed around it. It may, in some instances, be necessary to give the tag a quarter turn, and again squeeze it between the tools, and as this will have the effect of thoroughly uniting the tag to the lace, it admits of the tag being made much shorter than they are now used, a great advantage where neatness is required; and should it be desirable that the tags should be cut in two at the time they are indented, the two bits of steel used in the centre must not in that case be indented.

The patentee claims, "the mode of applying tags to laces, as herein described, whether such tools be used singly, vertically, horizontally, or in any other way, and without any reference to the means by which such tools may be put in motion. Secondly,—the herein-described and exhibited means of better securing tags to laces, by indenting them transversely with a circular groove or grooves, as represented at fig. 4., without any regard to the number of such grooves, or to the size of the tag on which they may be formed."

To THOMAS CHANDLER, *of Rotherhithe, for a lever cask stand.*—[Dated 4th July, 1856.]

THIS invention relates to a lever stand or tilt for supporting casks, which is mounted and somewhat nearly balanced on a central fulcrum, on which it is tilted, to alter the position of the cask as required: the cask being nearly on a balance, the tilting is easily effected.

The figure in Plate VIII., represents a side elevation of the stand, with the lever support partially tilted; also showing in dots the position of the tilt when about to horse the cask. *a, a*, is the lever tilt, composed of two side rails, held together by cross ties, *b, b*. *c*, is an iron bolt, which acts as the fulcrum on which the tilt *a, a*, moves. The fulcrum, *c, c*, is sustained in bearings on two supports, *d, d*, fixed on the base *e*. *f, f*, is the ratchet arm, jointed to the front bar *b*, of the tilt, and received in a stop-piece *g*, fixed to the base *e*. The enlarged end of the ratchet arm will not pass through the loop of the stop *g*, and prevents the cask from overbalancing backwards. The ratchet teeth *i, i, i*, abut against the stop *e*, and support the cask tilt in its several positions. When horsed, the cask is first placed in a horizontal position, in which position it remains until it requires to be tilted forwards, which is effected by raising the lever arm *f, f*, a little, and allowing one tooth *i*, to slip through to the stop; and afterwards, when required, another tooth *i*, is allowed to slip, and so on.

The patentee claims, "the arrangement and construction of lever cask stand or tilt, hereinbefore described, and represented in the drawings hereunto annexed."

To PETER CATO, JOHN MILLER, jun., *and* JOHN AUDLEY, *of Brunswick Dock, Liverpool, for improvements in the manufacture of ships' knees.*—[Dated 6th November, 1856].

IN the manufacture of ships' knees, according to this invention, the iron is first forged to a tapering form from the part to be bent towards each end,

by means of a plain-faced hammer or tool, worked by steam or other power. The face of the anvil, or the tool on the anvil, is formed with angular or proper shaped grooves, according to the form of the intended elbow or bend of the intended knees. The tapering of the other parts of the bar of iron is accomplished by the same hammer acting on the iron when on other parts of the anvil. The iron being thus forged, is next to be bent into form (which is preferred to be done hot). The hammer or tool is formed with a face corresponding with the interior bend or angle to be given to the knee, and the anvil or tool thereon is made hollow, to correspond with the exterior bend or angle intended to be given to the ship's knee.

In Plate VIII., figs. 1, and 2, are peculiarly shaped hammer and anvil faces, attached in the usual manner to any kind of forge hammers, whether worked, by steam, their own gravity, tilt, helve, vacuum, air or water pressure, or any stamping or punching apparatus of any description, and by which means forged or malleable iron is bent to any angle, "set" of angle, or curve pieces, either in a hot or cold state. The V or U-shaped jaws in the anvil faces, and the corresponding projections on the hammer faces or ram, as shewn at fig. 3, are for the purpose of bending the pieces of iron required to be bent, and which will be made of various angles, bevilled angles, and curves, to suit the nature of the work. For small variations in these angles and curves, or even in the bevilled angles, and to admit of quickness of working, iron, steel, or metal slices, of shapes resembling figs. 4, are used. The flat faces of figs. 1, and 2, are intended to prevent the bulging out unequally of the piece of iron while bent in the V or curved jaws, and by which the workman may strike the iron sideways when he perceives any such bulging or widening out.

In some instances it may be found convenient to have these anvil faces, jaws, and hammer faces, &c., separate, in different machines, or attachable to the same machine at different times, and not in the compound shape, as shewn.

The patentees claim, their use in that mode, as well as in the compound shape; and they also claim the use and application of such or similar hammer faces, anvils, and slices to any description of forge hammers, or stamping machinery of a like nature, whether worked by steam, air, vacuum, tilt, helve, water power, or pressure; and especially to their use and application in any such machinery as above described, for the manufacture of iron knees, riders, crutches, and breast-hooks required for ships, known as 'ships' iron knees.'

To CHARLES VAUGHAN, WILLIAM JAMES VAUGHAN, and RICHARD VAUGHAN, *all of Birmingham, for a new or improved strap or band for working stamps, raising weights, and transmitting power generally.*— [Dated 8th November, 1856.]

THIS invention consists of a strap or band, made of a thin strip or strips of iron, copper, brass or other such metal or alloy as combines sufficient strength with the requisite elasticity, that is to say, an amount of elasticity which will permit of the said strap or band working over a pulley without taking a permanent set. Although the new or improved strap or band is applicable for the transmission of motion in all cases where straps

or bands of leather or gutta-percha are ordinarily employed, yet the invention is more particularly applicable for working stamps.

The figure in Plate VIII., represents a front elevation of a stamp, worked with a strap or band constructed according to this invention. *a*, is the strap or band, consisting of a strip of hoop iron or other metal or alloy. The strap passes over the pulley *d*, to which a rotatory motion is communicated by the pulley and band *e*, or otherwise. *f*, is a handle attached to the end of the band or strap *a*; and *g* is the hammer of the stamp fastened to the end of the strap. When the handle *f*, is not pulled downwards, the band *a* does not lie close upon the pulley *d*, its elasticity causing it to assume a curvature of larger radius than that of the pulley *d*; the band consequently only touches the pulley *d*, in two or three places, and the pulley *d*, in rotating, slips freely under the strap or band, with little friction. When, however, the handle *f*, of the band is pulled, the band is made to bear upon the upper half of the pulley *d*, and the friction of the band upon the pulley causes motion to be transmitted to the band, and the hammer *g*, thereby to be raised. When the hammer *g*, has been raised to the requisite height, the workman loosens or slackens the handle *f*, when the elasticity of the strap or band causes it no longer to "bite" the pulley *d*, but to loosen its hold on the said pulley; and the hammer *g* immediately falls without obstruction, and is again raised by the workman pulling down the handle *f*. The pulley *d*, is kept in a state of uniform rotation by steam or other power.

For raising minerals out of mines, and for raising weights and transmitting power generally, the new or improved strap or band is used as the ordinary chain, rope, leather, or gutta-percha bands are used.

The patentees claim, "the new or improved strap or band for working stamps, raising weights, and transmitting power generally, hereinbefore described, and illustrated in the accompanying drawing, that is to say, a strap or band, made of a strip or strips of metal or metallic alloy, either alone, or in combination with leather or other flexible material."

To JOSEPH BARRANS, *of New Cross, for improvements in apparatus for applying oil or lubricating fluid to the axles of railway carriages and locomotive engines.*—[Dated 21st November, 1856.]

THE nature of this invention will be readily understood by reference to the figure in Plate VIII., which shews a longitudinal section of a railway axletree box, having the improvement applied thereto. *a*, is a roller or cylinder below the axletree. The lower part of the surface of the roller or cylinder *a*, revolves in the lubricating fluid, and its upper surface communicates such fluid to the under surface of the axletree, against which the roller or cylinder is constantly pressed, by springs at a^1, under the axles of the roller or cylinder *a*. In order to prevent too much lubricating fluid being carried up by the roller or cylinder *a*, a cover *b*, acting as a doctor or scraper, is used; but this, if preferred, may be dispensed with. The figure shews the application of only one roller or cylinder *a*, but more may be used if desired; in which case it is preferred that there should be partitions across the box, to divide it into several compartments, and that the compartments should only communicate with each other by a small hole through each partition, by which the lubricating fluid will be generally kept to a like level in the several compartments of the box; and

in the event of any sudden inclination, the lubricating fluid will only pass slowly through the partitions. *c*, is a plug by which a supply of fluid is allowed to be introduced into the box. In order to prevent the lubricating fluid getting away, and also to prevent dust or dirt getting into the box, a metal ring *d*, is used, which embraces the axle. The ring *d*, is made in two halves or parts, and the upper part rests on the axle by its own weight, and the lower part is kept up thereto by a tight spring d^1. *e*, is a stop for adjusting the end play of the axletree, and it is kept in position by a set screw.

To Charles Edwin Heinke, *of Great Portland Street, for improved apparatus for illuminating objects beneath the surface of water, or for giving light in mines, and other places where combustible or explosive gases exist.*—[Dated 24th November, 1856.]

This invention consists, first, in a novel or improved mode of supplying the lamps employed for giving light, with air to support combustion, and also of carrying off the smoke, carbonic acid, and other products of combustion; and, secondly, in adapting to such lamps reflectors, condensers, or lenses, which will throw the light of the lamp with great intensity and brilliancy in the required direction.

The figure in Plate VIII., is a vertical section of a submarine lamp, constructed according to this invention. The casing or body of the lamp is made of sheet copper, and it is composed of two cylinders *a*, and *b*, placed concentrically, one within the other, so as to leave an annular space *c*, between them. The foot of the lamp is composed of the same material, and is also made hollow, as seen at *d*, *d*. The internal part of the hollow foot is perforated with small holes, as seen at *e*, *e*, for the purpose of admitting air from the annular space *c*, to the interior of the lamp. The casing has any convenient number of condensing lenses, fitted to suitable openings made in the casing, as shewn at *f*, *f*, *f**, and, if required, reflectors may be adapted in such a manner to the lamp, as to throw the light through the condensing lenses. It will be seen that there are two lenses *f*, *f*, adapted to the sides of the casing, for the purpose of throwing the light forward in a horizontal direction. There is also another condensing lens *f**, adapted to the foot of the apparatus; and above the light is placed a horizontal metal reflector *g*, which will throw the light down through the bottom condensing lens, and thereby cast a brilliant light on anything below. The lamp *h*, is of the ordinary Argand kind, and is supplied with oil from the reservoir *i*, which is made of an annular form, for the purpose of allowing the light from the flame of the lamp to pass through to the condensing lens *f**, below. The lamp is secured in vertical slotted guides *j*, *j*, fixed to the sides of the casing; it is of course provided with a glass chimney, for the purpose of steadying the flame, and the reflector *g*, is placed on this glass chimney, and may be secured, at any suitable altitude thereon, by means of spring clips, as is well understood. The gaseous products of combustion pass up the glass chimney, from the flame into the trumpet-mouth *k*, of the vertical tube, which communicates with the hose or flexible pipe *l*, above; the connection between the two pipes being effected by means of a screw-joint at the top of the dome-cover of the apparatus, as seen at *m*. This cover is screwed on to the top of

the apparatus,—a leather or other washer *s*, being placed on the flange, whereby the two parts are united. Air, to support combustion, is supplied to the lamp down a flexible tube or hose, which is adapted to a short branch-pipe, secured to the sides of the casing, and made to communicate with the annular space between the inner and outer casings. This branch-pipe is provided with a cock, whereby the supply of air to the interior of the apparatus may be regulated at pleasure. The whole apparatus is suspended from above by means of cords or chains, attached to the eyes *r*, *r*, at each side. The hose is made of vulcanized india-rubber. It is scarcely necessary to observe that this hose may be divided into convenient lengths, which may be temporarily joined together, as circumstances may require, by means of union-joints, so as to form a continuous length.

A modification of the above may be made by having three side condensing lenses, and metallic reflectors combined therewith, so as to throw the light forward through the condensing lenses. If desired, the bottom lens, shewn at *f**, may be dispensed with in some cases, and a hollow bottom used in its place.

The patentee claims, "the general arrangement of parts herein shewn and described, whereby a convenient and effective illuminating apparatus is produced. Also, the mode above described of supplying air to the burner, to support combustion; and also the use and application to submarine and other analagous illuminating apparatus, of a hollow air-space or chamber, into which air is forced from above, by any convenient forcing apparatus, to supply the lamp, placed inside, with air to support combustion. And further, the application to such illuminating apparatus of condensing lenses and reflectors, for the purpose of concentrating or throwing the light in any desired direction."

To William Colborne Cambridge, *of Bristol, for an improved construction of portable railway.*—[Dated 11th December, 1856.]

This invention relates to a novel construction of portable or endless railway, to be applied to the wheels of engines and carriages, for the purpose of facilitating their movement over loose ground and irregular surfaces. In carrying out this invention, a set of plates or sustaining pieces, made flat on their under face, is adapted to each wheel, which plates severally receive in turn the pressure of the wheel as it revolves. They are connected together by being jointed to a double set of levers, which act as links, and bind all the parts together into an endless railway. At about the middle of the length of the sustaining pieces, and at either side thereof, lugs are formed to receive the junction pins of the levers or links, and they also act as guides between which the wheel runs. The sustaining pieces are provided with bearing rails, to receive the pressure of the periphery of the wheel, and being thus supported at the middle of their length, they are severally free to take up a horizontal position, or adjust themselves to the irregularities of the road or way, before the pressure of the running wheel comes upon them; thus the action is rendered smooth, and no unnecessary strain or wear is put upon any parts forming the portable railway.

In Plate VIII., fig. 1, is a side elevation of the portable or endless railway, adapted to a wheel, which may be supposed to belong to a portable

steam-engine, steam-plough, or other implement; and fig. 2, is a transverse section of the same. *a, a,* represents a wooden wheel of the ordinary construction, and provided with an iron tyre, as usual. The portable railway is divided into sections, consisting of an iron rail *b*, which has a projecting rib made along its centre from end to end, and is bolted or secured to a thick wooden plate *c*. Side pieces or guides *d, d,* made of angle iron, are secured, in any convenient manner, on each side of the central projecting rib of the rail. These pieces, by forming a kind of groove in which the wheel runs, serve to keep the wheel on the central projecting rib of the rail. Lugs or ears *e, e,* are bolted to the rail, and are provided with centre pins, bolts, or studs, which pass through holes at the end of the rods *f, f,* whereby the several sections of the railway are jointed or connected together. It will be seen that the railway is in no way connected or attached to the wheel, but is entirely independent of the same, and merely forms a kind of endless chain round the periphery of the wheel, from which it may be removed by simply withdrawing the centre pin or bolt from one of the pairs of rods *f, f,* so as to break the continuity of the endless chain; the wheel will then assume the appearance of an ordinary wheel, and may then travel in the usual manner on common roads, but the portable endless railway may be adapted thereto again with facility, when required. It will also be evident, that as no special mode of constructing the wheel is required, the same railway may be adapted to any ordinary wheel of the same dimensions.

The patentee claims, "the mode herein shewn and described of constructing and adapting portable railways to the running wheels of carriages."

To JAMES LARK, *of Vauxhall Cross, for improvements in kilns for burning materials in the manufacture of lime and cements.*—[Dated 23rd December, 1856.]

THE improved kiln, forming the subject of the present invention, is shewn in vertical section in Plate VIII. The kiln is of a conical form, closed in at top, as shewn, leaving an opening at the upper part for feeding in the materials to be burned; and at the bottom there are four openings for withdrawing the charge as it becomes burned and cooled down. *a, a,* is the outer masonry of the kiln; *b, b,* is a lining of fire-bricks, at such a distance from the inside of the outer masonry as to admit of the space being formed into flutes or passages for receiving atmospheric air, and such lining is bonded into the outer masonry at suitable intervals, as shewn in the figure. The space between the lining and the outer masonry is divided horizontally at *c, c*; and there are air passages *d, d,* at the bottom, by which atmospheric air may pass freely into the space between the lining and the outer masonry. There are other passages *e, e,* by which the air, as it becomes heated, may pass out; and the same may, by suitable flues, be conducted in any direction, in order to be used for heating and drying purposes; and the speed at which such heated air is allowed to pass off may be regulated by a valve in the flues which are in connection with the lower space, between the lining and the outer masonry of the kiln. The upper space between the lining and the outer masonry of the kiln has openings at *x, x,* which may pass from the upper part of the kiln into the

space between the lining and the outer masonry, and so that the heated air and products above the materials which are being burned may pass into such space, and downwards through the upper space. Openings are made at *f*, *f*, for the heated air to pass away from the upper space; it may then be conveyed by suitable pipes or flues, and used for heating and drying purposes. The speed at which such heated air shall pass out of the upper space may be regulated by suitable valves applied to the conducting pipes; or the openings at *x*, *x*, may be formed through the lining and through the outer masonry, so that the products may pass out, as indicated by the larger arrows. In addition to the spaces between the lining and the outer masonry of the kiln, there is constructed a central hollow shaft, with an external lining constructed in such manner as to leave a hollow space between the lining, and the external surfaces of the internal hollow shaft; and passages are arranged to communicate with the outer atmosphere, in order that air may constantly flow into and from the hollow shaft, and into and from the space between it and the lining around it; and from such central space into the space at the upper part of the kiln, as is indicated by the arrows. By these means the lower part of a kiln may be kept cool, and the same will admit of a continued process of feeding at top of the kiln, and withdrawing of the finished charge from below, and a very large quantity of heated air will be obtained for drying and heating purposes, whilst the lining and other parts of the kiln will be preserved.

The patentee claims, "the construction of kilns, with air spaces, as herein described."

To THOMAS SHAW, *of Ilkeston, Derbyshire, for improvements in furnaces or fire-places.*—[Dated 27th December, 1856.]

THIS invention relates to a novel mode of actuating the grate bars of furnaces, for the purpose of preventing clinkers from adhering thereto, or sticking between the bars, and stopping the draft. The fire bars are supported at their under sides, and at each end, upon rocking arms or levers, which are arranged together in pairs, and are mounted upon two common rocking shafts, connected together by means of a rod extending longitudinally under the fire bars, from back to front of the furnace; so that upon communicating a rocking motion to either shaft, by means of suitable mechanism, every alternate bar of the whole series will be raised up at both ends simultaneously to the same height, while the remaining alternate bars will be depressed simultaneously in a similar manner. This effect is produced by mounting the rocking arms or levers upon their shafts in such a manner, that one arm of each pair will be before the rocking centre, while the other arm of each pair will be behind the said centre. It will, therefore, be evident, that when one of the arms is raised, the other must be depressed, and *vice versâ*; and by the oscillation of the rocking shafts one half of the fire bars will be raised, while the others are depressed, and thus all danger of clinkering the fire bars is effectually prevented.

The figure in Plate VIII., is a longitudinal section, taken through a set of grate bars, shewing one set of bars as elevated, while the other set is depressed. *a*, *a*, *a*, and *b*, *b*, *b*, are sets of fire bars, arranged alternately side by side, and supported at their ends upon the rocking arms *c*, *c*, which are mounted on the rocking shafts *d*, *d*, and are connected together by the long

rods *e*, so that both shafts may act together. The end a^* of the rocking arms supports the fire bars *b*, and the other end b^* of the rocking arms supports the fire bars *a*. *f* is a lever, fixed to one of the rocking shafts *d*, or to the rocking arms *c*, keyed thereon: and by moving the lever up and down, the necessary vibrating motion is communicated to the rocking shafts and arms, and by this means a rising and falling motion is imparted to the fire bars. Of course, when the rocking shafts are vibrated in the opposite direction, the position of the fire bars will be reversed.

The patentee remarks, "that the effect intended to be produced by this invention can be obtained as well by moving the lever from time to time by manual labour, as by actuating the same by mechanical means, as it is not necessary to keep the fire bars constantly in motion. He claims the mode herein shewn and described, of actuating the grate or fire bars of furnaces or fire-places, for the purpose above set forth."

To JOSEPH HENRY GEORGE WELLS, *of Essex-street, Strand, for improvements in pumps, and valves used therewith,—being a communication.*—[Dated 29th December, 1856.]

THIS invention is more especially adapted to ships' pumps. In Plate VIII., fig. 1 is a vertical section of the pump, shewing the valves. The body of the pump *c*, is fastened to the deck *a*, of the vessel, with the suction pipe *f*, bent as a syphon, also secured to the deck by a collar *h*. The liquid enters the suction pipe by a large opening at its base, and not on the sides, and is formed in such a manner, that a flat body cannot adhere to it and obstruct the passage of the liquid. All the solid matters, wood, stone, or otherwise, of a size less than the suction pipe, are absorbed by the ascending current of the water. At the upper part of the syphon *f*, is placed a little cock *g*, for introducing air into that part of the suction pipe, as soon as the pumping is done; and by such admission of air the liquid is retained in the descending part of the syphon and in the body of the pump *c*, by which means the body of the pump *c*, the reservoir *d*, part of the syphon *f*, and the valves *k*, and *i*, are in the liquid, even when the pump is not at work; and by closing the cock *g*, the pump is again ready for use.

With the above precautions, suet, oil, fine coal powder, tow, gravel, greasy rags, &c. are kept in suspension in the liquid, and cannot accumulate and form a paste-like cement, which soon renders the playing of the pump impossible. Fig. 2 shews the form of the valves used. Its lower part is of a cylindrical form, terminating with a lip; and at its upper extremity are hung two valves of wood, metal, or other suitable substance, in form and action similar to a bivalve shell; when full open, the area is equal to the open lower end. The whole is encased in a tube of leather or other suitable substance, so as to be open at top and bottom,—a flange on the outer surface of the lower part serving as a seat for the tube. a^1, is the lower cylindrical part; b^1, b^1, the shell valves, shewn closed; c^1, the leather tube; and d^1, the flange. If, at the end of a stroke of the piston or bucket *p*, a solid body should be passing through either of the valves, it will, owing to their ductile substance, adhere to it, and the pump will continue its work; and at the next similar stroke it will be drawn through the valve, and finally discharged at the pipe *b*, without the possibility of producing a stoppage in the valves. The valve *k*, is fixed on the piston or

bucket *p*, and the valve *i*, is fitted to the reservoir *d*, at *x*, in any convenient manner. *e* is a moveable muffle, or coupling box, fixed at *s*, by means of a stuffing box or lid, and easily ascends the syphon *f*, of the suction pipe, when it is necessary to repair or change the shell valve *m*. A screw plug *r*, is provided at the bottom of the reservoir *d*, to give easy access to the valve *i*. The reservoir, pump, and part of the suction pipe can be emptied by means of the screw plug *q*. The pump rod *o*, may be connected to the usual brake, or to any convenient mechanism.

The patentee claims, "maintaining the pump always ready to work, by means of the syphon, so that the valves are always kept in the liquid; as well as the construction of the valves for preventing any possible obstruction of the working of the pump, substantially in the manner as shewn in the accompanying drawing, and herein fully described."

To JOHN TALBOT PITMAN, *of Gracechurch-street, for a machine for making carpet lining and other similar articles,—being a communication.*—[Dated 1st January, 1857.]

THE nature of this invention for making carpet lining consists in operating, by mechanical means, two rollers or spindles, containing sheets of paper or fabric rolled thereon, so arranged in relation to a sheet of cotton batting or other suitable material, whether the same be placed upon an intermediate roller, as hereinafter described, or supplied by other suitable arrangements, that when the paper sheets are unrolled they shall encase between them the cotton sheets; also, in compressing between another set of rolls this combination, as it moves onward,—the cotton sheet resting on the lower or under sheet, as upon an apron; also, in the mode of folding and measuring the same; also, in the construction of the platform on which the lining falls; also, in the arrangement of the apparatus for sizing, when required, the inner sides of the paper sheets, in order to render the combination more perfect by the consequent adhesion.

The figure in Plate VIII. represents a side elevation of the improved machine. *a*, is the frame; *b*, *b*, are spindles, hung at different elevations horizontally athwart the frame. These spindles rotate in stationary bearings *c*, *c*, attached to the frame. On each spindle is wound the paper, in a continuous sheet *d*, *d*. *e*, is another spindle, holding the cotton bat *g*, resting in oblique slots *f*, and parallel with and intermediate between the spindles *b*, *b*. The oblique slotted bearings enable the spindle to advance as the lap upon it decreases in the continuous revolution. This cotton sheet rests upon the lower roll of paper, and is supported and drawn onward by it towards and between two rollers h, h^1, placed one above the other in vertical bearings *i*, and which act as pressure rollers. To the shaft of the roller *h*, the driving power is applied. j, j^1, are two rollers, placed in advance of, and on a level with, the rollers h, h^1, each having two longitudinal ridges k^1, k, and grooves *l*, *l*, so adjusted that the ridge of one roller shall be the counterpart of the groove in the other, and *vice versâ* alternately. These rollers, called the "creasing rollers," are in circumference, including the ridges and grooves, exactly two yards; or measure exactly half a yard from one ridge to the next groove; and by the alternation, create a fold, serving a two-fold purpose, in connection with a platform or box, placed under the delivery of the said rollers, namely, depositing the material in

uniform folds, each of which represents exactly one yard of the stuff; and the stuff is thus, without any further manipulation, accurately measured off, and conveniently folded for baling. This peculiar mode of folding becomes necessary from the nature of the paper, which not being susceptible to stretching, a continous folding or rolling of the material in one direction, besides preventing the above-described method of measurement, would result in a wrinkling of one of the paper layers, that would interfere with the smooth disposal of the lining upon a floor. *m*, is a platform, to receive the lining from the creasing rolls. *n*, is a temporary front, which, being held up by a pawl *o*, during the folding of the stuff, can be let down to permit of the removal of the piece for baling. The two creasing rollers are geared, so as to ensure their equal action and rotation. p, p^1, are troughs containing vegetable mucilage. In these troughs are hung cylindrical brushes q, q^1, which are capable of rotation. These brushes, by means of counterbalances *r*, are made to press and revolve against the intended inner surfaces of the paper, covering them with a thin coating, and creating a bond of union between the surfaces of the filling and the inner surfaces of the paper.

When the machine is intended to manufacture a lining or wadding, without the necessity of any strong adhesion between the intermediate layer and the external sheets of paper or cloth, the pressure alone will be sufficient, and the brushing apparatus may be dispensed with.

This machine is useful not only for making carpet lining and wadding, but also for making boiler covering, cardboard, bonnet board, and for similar purposes, where an union of two or more sheets is desired.

The patentee claims, "First,—the arrangement of the spindles on which the outer sheets are placed, in combination with the intermediate spindle containing the inner layer, or without it; the same being operated in the manner and for the purposes substantially as described. Second,—the arrangement and employment of the rolls h, h^1, in combination with the last-mentioned arrangement, for the purposes substantially as herein set forth. Third,—the arrangement and construction of the creasing rolls j, j^1, when used in this connection, for the purpose of folding and measuring, substantially as described. Fourth,—the arrangement of the sizing or glueing apparatus, operated in the same manner, and for the purposes substantially as specified. Fifth,—the box or platform, with a falling front, substantially as described, and for the purpose mentioned."

To JOHN JAMES RUSSELL, *of Wednesbury, and* JOSEPH BENNETT HOWELL, *of Sheffield, for improvements in the manufacture of steel tubes, applicable to the flues of steam-boilers and other uses.*—[Dated 8th January, 1857.]

THIS invention has for its object improvements in the manufacture of steel tubes, applicable to the flues of steam-boilers and other uses; and the improvements consist in causing the steel, after it has been converted in the ordinary manner, to be rolled into sheets of the width, length, and thickness required, then cutting the edges into the proper form, according as a lap or butt weld is to be made. The sheets thus prepared are then turned up, so that the edges meet, or nearly so; and when raised to a welding heat the welding of the edges is performed by external pressure, by dies

or by grooved rollers, with or without the aid of internal supports or mandrils.

The patentees claim, "the manufacture of wrought-steel welded tubes, applicable to the flues of steam-boilers, and other uses."

To GEORGE EDWARD DERING, *of Lockleys, Herts, for improvements in lighting and warming trains of railway carriages.*—[Dated 28th January, 1857.]

THIS invention consists in combining apparatus in a suitable manner for employing gas to be burned in the various lamps used in a train of carriages, for signals, and for lighting the interiors of the passenger or other carriages, and in suitable stoves or other apparatus for warming the same, in place of employing oil or candle lamps for the purpose of signals and illumination, and vessels of hot water for warming the carriages, as at present.

For the accomplishment of this object, it is preferred to attach a separate carriage or truck, of light construction, to each train, for carrying the requisite quantity of coal or other gas in suitable holders or gasometers; using, by preference, bags or flexible holders, pressed on by water or other liquid, or by weights or springs, and supported upon springs. Each carriage of a train has, by preference, permanently attached to it a length of gas pipe from end to end, communicating by branch pipes with the several burners, each such main length of pipe having a length of flexible tubing attached thereto at both ends, with stop-cocks and gas-tight couplings, to facilitate the joining up of the main gas pipes throughout the length of the train, and each separate burner having a stop-cock, as usual in gas lighting.

In order to prevent the endosmodic mixture, which usually takes place between gas contained in flexible holders and the surrounding atmosphere, it is preferred to envelop them in a jacket of water or other liquid. And, in order to ensure a good light, it is advisable, particularly when bags or flexible gasholders are employed, to bring the gas into contact with benzole, or other suitable hydrocarbon, either in the holder, or in its passage from thence to the burners.

The apparatus is, by preference, arranged to be under the control of the guard or other officer travelling with the train, by means of cocks or valves, in such manner, that all the lights, or some of them, can be modified at pleasure in the extent of their flames, by which means the expenditure of gas may be economized almost to nothing during daylight, except whilst passing through tunnels, and a ready means is afforded the guard of attracting the attention of the engine driver, by modifying the supply of gas to a burner within his view; and there may even be carried on telegraphic conversation between different parts of the train, by varying the character of distant gas-lights, according to an established code of signals. The stop-cocks for all which purposes may have stops or checks to the movement of the handle regulating the orifice, or graduations to determine its position, or other devices to obviate the risk of extinguishing the lights, when intended only to diminish them.

In order to avoid the inconvenience of the lights being extinguished during temporary disconnexions of the carriages of a train at the various

stations, there may be attached to each separate carriage, in connection with its pipe and burners, a small gasholder, acted on by springs or other pressure, but of less force than the pressure of the main reservoir.

The patentee claims, "fitting up railway carriages with pipes and other appliances, whereby to convey gas from reservoirs carried with the train to suitable burners, for the purpose of lighting, warming, and signalling, and the various accessory and precautionary arrangements herein described."

To JOHN HENRY JOHNSON, *of Lincoln's-Inn Fields, for improvements in the treatment of flax and similar textile materials,—being a communication.* —[Dated 4th February, 1857.]

THIS invention relates, first, to an improved mode of treating flax and other similar fibrous substances, whereby the old and injurious process of retting is dispensed with; and the total removal of the gummy or resinous matters contained in the flax or other similar fibrous material is effectually accomplished with a great economy of time and labour, whilst the texture of the fibres is greatly improved, and a considerable reduction in the waste of material effected. Secondly,—to an improved mode of effecting the perfect division or separation of the fibres after they have been freed from the gummy or resinous matters.

Supposing, for example, a weight of about twenty pounds of flax is to be operated upon,—after it has been already freed, as much as possible, from its straw or woody matters, it is boiled for about two hours in seventy-four gallons of water, wherein about three pounds of simple crystallised or calcined soda have been dissolved. The fibrous substances having been then removed from the boiler, and well wrung, so as to remove the greater portion of the solution therefrom, are now placed for fifty or sixty minutes in about thirty-five gallons of water, with which about four and a half gallons of sulphuric acid have been previously mixed, after which they are well rinsed in warm or cold water, and then well pressed. The material is then dried by a moderate heat, and the fibres are separated by mechanical or other ordinary means. When operating on substances steeped or retted as in the old process, this drying is not required. The fibrous material is now placed for about half an hour in about thirty-nine gallons of water, in which about three and a half pounds of bicarbonate of soda have been dissolved. It is then withdrawn, the surplus liquid is expelled by compressing it lightly, and it is immersed for ten or fifteen minutes in about thirty-five gallons of water, with which about one pint and a half of sulphuric acid have been mixed. The material having been washed, rinsed, and dried, the process is complete.

The patentee claims, "First,—the system or mode of treating flax and other similar fibrous substances, with a view to the removal of the resinous or gummy matter therefrom, as hereinbefore described. Second,—the system or mode of treating flax and other similar fibrous substances, with the view of effecting a perfect separation of the fibres thereof, as hereinbefore described."

To James Garth Marshall, *of Leeds, for improvements in preparing flax, hemp, China grass, and other vegetable fibrous substances.*—[Dated 22nd January, 1857.]

This invention relates, in the first place, to the preparation of a peculiar kind of soap, to be employed in the treatment of flax, or other vegetable fibre; and, secondly, to the admixture with the soap, in solution (with or without an excess of alkali), of mineral or other naphtha, turpentine, or other volatile or essential oils or spirits, for the purpose of dissolving the gummy or resinous matters adhering to the fibres.

In the preparation of the soap above mentioned, the patentee employs the oleic acids of oils and fats, obtained by means of distillation. The oleic acid is saponified in the usual manner, and the soap thus produced is used either with or without excess of alkali. Glycerine may be used instead of or in addition to a corresponding quantity of oleic acid. The soap made from these materials is applied to the vegetable fibre, according to the principle laid down in the specification of a patent granted to Francis Montgomery Jennings, dated November 15th, 1852. In employing the naphtha, turpentine, or other volatile or essential oils or spirit, the object is to facilitate the removal of the gummy or resinous matters adhering to the vegetable fibre. They are used in conjunction with the alkaline or soapy solution above mentioned; being simply mixed and agitated, in their crude state, with the alkaline or soapy solution, immediately previous to the immersion of the fibre therein. The proportion of naphtha or other volatile or essential oil to the soap is not material, and may be considerably modified, according to the nature of the material to be operated upon; or the naphtha or other solvent may be used without any soapy solution, by saturating the fibres in the crude naphtha and expressing the superfluous liquid, by passing the fibres between pressing rollers, or by other modes, and then subjecting the fibre to alternate alkaline and acid solutions.

The patentee claims, "the treatment or preparing flax, hemp, China grass, and other vegetable fibrous substances, with a solution of soap made from glycerine, oleine, or oleic acid, from which the stearic, margaric, and other solid fatty acids have been removed by any convenient process. And also the use, in combination therewith, or in the manner above set forth, of mineral or other naphtha, turpentine, or other volatile or essential oil or spirit, for dissolving (and cleaning the fibres from) gum or resinous matters."

To William Watt, *of Belfast, for improvements in treating or preparing Indian corn, and other grain and amylaceous vegetable substances, for fermentation and distillation.*—[Dated 10th January, 1857.]

This inventing is applicable to the treatment or preparation of Indian corn, wheat, rice, beans, and other grains and amylaceous vegetable substances.

In operation upon unmalted Indian corn or maize, the patentee prefers to place a quantity of the whole corn in a vessel, and to cover it with hot water, and allow it to steep for a few hours. The heat may be kept up, if necessary, by a steam-pipe, or by any ordinary means. He then mixes the

steeped corn with a quantity of malted barley, equal to about one-fifth of the Indian corn employed, and grinds them together by ordinary mill-stones, and causes a current of water, at a temperature of about 160° or 170° Fahr., to flow through the stones. A liquid mixture or mash is thus obtained, which is allowed to run into a mash-tun or other suitable vessel. The starch in the grain is soon converted into sugar, and the sweet wort thus produced is fermented, and distilled, or boiled with hops, and fermented, or otherwise treated, by the ordinary distillatory or brewing processes.

It is not necessary that the malt should have been kiln-dried in the ordinary manner, and it is preferred to use it in its damp and fresh state, thus saving the expense and loss of time incurred in drying it. When, however, dried malt is employed, it may be ground up with the unmalted corn, as hereinbefore described; or it may be ground up separately with water; or it may be crushed in the ordinary manner, and added to the mash produced by grinding the unmalted corn separately with water. The temperature of the water employed in the steeping and grinding may be varied according to circumstances. Thus, if the water is employed at a temperature below 140° Fahr., the starch may be separated without being dissolved, and the husks may be removed by passing the mash or liquid through a sieve; and if the mash should become too cold it may be warmed, so that the temperature of the mixture may be suitable for the action of the diastase in the malt upon the starch, which temperature is from about 140° to 170° Fahr. When the malt is mixed with the corn in the grinding process, the temperature of the water employed must not exceed 170° Fahr., otherwise the diastase in the malt might be injured. In like manner, if malted or partially malted corn is used, the temperature of the water employed in steeping and grinding it must not exceed the like temperature; wheat and barley and other grains may be treated in a similar manner. In applying the invention to potatoes and similar amylaceous vegetable substances, a portion of malt is to be added, as hereinbefore described. The mode of treating the grain or other amylaceous vegetable substances by the series of successive operations hereinbefore described, prepares them for the purposes of fermentation and distillation, by exposing the particles of starch contained in the substances more completely to the action of the diastase, and thus causing the production of a larger quantity of sugar than is the case when the substance is merely crushed or ground in a dry state, as in the ordinary process of crushing or grinding malt or corn for brewing and distilling purposes.

The patentee claims, "the mode or modes hereinbefore described of treating or preparing Indian corn, and other grain and amylaceous vegetable substances, for fermentation and distillation, by the process of malting or partially malting, or adding malt to them, in combination with the processes of steeping and grinding with water, as hereinbefore described."

To Francois Auguste Verdeil, *of Paris, and* Edmond Michel, *of Puteaux, France, for improvements in obtaining extracts from madder for dyeing and printing.*—[Dated 13th January, 1857.]

This invention has for its object improvements in obtaining extracts from madder for dyeing and printing, and consists in crushing the madder root and extracting it with an alkaline liquid, from which the coloring matter is afterwards precipitated by an acid. The crude coloring matter thus obtained is dissolved in alcohol or wood spirit, and the solution is distilled, to again separate the alcohol or wood spirit; the pure coloring matter remains in the retort.

In carrying out this invention, the madder root is swelled by soaking it in water, slightly acidulated with sulphuric acid, and is crushed by passing it between rollers, in order to separate as much liquid as possible from the crushed root; it is pressed by means of a hydraulic press. The crushed root is, after it has been pressed, placed in a suitable vessel with a solution of potash or soda, marking from 2° to 4° Beaumé; a sufficient quantity of the solution being used just to cover the crushed root, which is left to soak for 48 hours or longer, when it is again pressed with the hydraulic press, and the resulting liquid is collected. The root is then again soaked, as before, in an alkaline liquid, which should be about half the strength of that first employed, and the liquid is again pressed out. The alkaline liquids resulting from the two pressings, or more, if wanted, are mixed together, and a sufficient quantity of sulphuric acid is added to precipitate the whole of the coloring matter. The precipitate is collected on a filter and well pressed, and then dried, and dissolved in boiling alcohol or wood spirit. The solution having been rendered clear by filtration, is put into a still, and the alcohol or wood spirit is distilled over,—care being taken to employ no more heat in this operation than is necessary to avoid injuring the coloring matter, which is then ready for use.

In order to dye a fabric with this extract, it is only necessary to dissolve it in water, and to immerse in the solution the fabric to be dyed, the fabric having been previously mordanted in the ordinary way, by which process the dyeing is so quickly made, that one or two minutes hardly are wanted. When the extract is to be used for printing, it is dissolved in water, and precipitated with acid. The precipitate is dried, mixed with a suitable vehicle, and the fabric is printed with it in the ordinary way.

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 173.)

The following paper, by Mr. R. C. Ross, of Glasgow, was next read:—
"*Description of a new machine for cutting and forging files.*"

The chief difficulty in the application of machinery for file cutting appears to have been the want of a proper modification of blow, suitable to the various depths of cut and breadths of the file required; and also

the proper adaptation of the teething tool, so that it may be steady in its action in the direction of the length of the file, and at the same time free to follow the transverse variations which occur when the tool is held at an angle across the taper part of the file, or any other variations which may occur, the files being often very far from the level.

In the machine described in the present paper, and applied by the writer for file cutting, the action in hand cutting has been followed as closely as possible. The machine consists of a hammer for striking, mounted in a cast-iron frame, working in connection with an arm for holding the tool; the hammer, as striker, and the arm, as tool-holder, are fixed in the framework, in the same relative position as the striking and holding arms of a man while in the act of cutting a file by hand.

The arm or tool-holder is suspended on centres in the framework, the centres being arranged to work in slots, in which they are adjusted by means of set screws, in order that the tool may be conveniently adjusted to any inclination required. The lifting motion of the arm is imparted to it by an excentric on the driven shaft, acting upon a curved lever bolted to the arm. The hammer is mounted on suspension centres at the necessary height above the arm, to correspond with the inclination of the chisel or tool, it being necessary that the hammer should fall at the same inclination at which the tool is held. The hammer is worked by a cam on the main shaft.

The tool or chisel is fixed in a moveable round block of iron, into which two double centres are inserted, the one centre resting in the tool and tool-holder, and the other in the moveable block and tool-holder. The centres are adjusted by a wedge or cotter, acting on a slip of steel, turning on a pin-joint, and into which one of the centres is inserted. The tool, by this means, is kept steady in the direction of the length of the file; and at the same time is allowed to turn or rock on the centres, so that it may at all times come fair to the face of the file, independent of all transverse irregularities that may occur in the file to be cut. These irregularities of surface are chiefly felt at the point of the file, where, in consequence of the oblique position of the tool across the file, the varying thickness or taper of the file exposes a varying surface, in proportion to the horizontal angle of the tool across the file or the obliquity of the cut; the one side of the tool being nearer the point of the file than the other, and consequently on a thinner part of the file; and the difference in thickness of course increasing as the taper of the file increases. The arm carrying the tool, is brought down on the file by means of a pair of springs, one on each side of the machine. There is also a hand lever on each side of the machine, connected to the tool by a joint-rod, to which a spiral spring is attached, which brings the tool and arm down on the file, and at the same time commands the tool on the turning centres, so as to bring it at all times fair to the face of the file.

For the purpose of making the reverse oblique cuts on the file during the return course, the tool is turned round in its holder after the first course, so as to reverse the obliquity of the cut to the extent required, and adjusted firmly in the new position.

The modification of blow given by the hammer is accomplished by means of a vertical bar, resting on the top of a spiral spring, and sliding upon a guide-rod, which rocks upon pivots at the bottom of the ma-

chine. This spring exerts its elastic force through the sliding bar, on the underside of the hammer lever. The sliding bar is shifted in front of or behind the suspension centre of this lever by means of a crank-arm, worked by a hand lever. The elastic force of the spring is thus made to regulate the force of the blow, in different degrees, in proportion to the distance of the point of action of the spring on either side of the suspenion centre. If moved to the extreme distance, in front of the suspension centre, the hammer will be completely poised and prevented from striking; and if moved to the extreme distance, behind the centre, the hammer will strike with its greatest force; the recoil of the spiral spring being then added to the force of the hammer in falling. At any point between these two extreme positions the effect of the blow will be proportionate to the distance at which the spring acts in front of or behind the suspension centre. By this arrangement, the force of the blow struck by the hammer is completely under the control of the person in charge of the machine.

The file to be cut is fixed by the tang upon a cast-iron block, which slides on a horizontal bed on the framework; and beneath the file there is a bed of lead or composition, to preserve the teeth on one side from injury, while the other side is being cut. The file is also held down on the block by a binding roller, carried in a frame, sliding vertically upon the framework of the machine, and pressed firmly down by a plate-spring, which is held down by a pin, inserted in a series of holes in a circular arm, so as to afford the means of adjusting the pressure; the roller is thus made to bear with uniform pressure on the surface of the file, close to the cutting edge of the tool. The roller, by the pressure of the spring, binds the cast-iron block to the frame of the machine, and likewise the file to the block, thereby ensuring a solid blow.

The binding roller also serves the purpose of filing after the first cut, a process, which is adopted in hand cutting to smooth down any irregularities that may arise from what is termed the first course; the roller being hard, and pressed firmly down on the file whilst traversing its entire length, answers the above purpose of filing or smoothing in the machine, and also saves time.

The feed motion, between each blow of the hammer, is imparted to the block carrying the file by means of two ratchets, pendent from the back end of the hammer lever; by the depression of this end of the lever, the ratchets communicate motion, by means of a screw and ratchet-wheels, to the block on which the file is fixed. The ratchet-wheels act in opposite directions, and the motion of the block is reversed at the end of each course, by means of a handle, by which one of the ratchets is thrown out of gear and the other into gear. Each depression of the back end of the lever moves the ratchet-wheel one tooth, thereby moving the block through the necessary distance for each cut to be made in the file; the ratchet-wheels being changeable, and the number of their teeth being proportioned, in each case, to the pitch of the screw and the number of teeth per inch required for each particular kind of file.

By these arrangements the separate motions of the hammer and file-block are carried on until the tool arrives at the end of the file, when a wedge-shaped stud, on the end of the block, comes in contact with an adjustable curved bar on the hand-lever, and pushes it out laterally, so

as to liberate it from the notches in an adjacent guide; the hand-lever immediately falls, bringing forward the sliding bar in advance of the fulcrum of the hammer, and thereby stops at once its movement, until another file is fixed, and the hand-lever again brought in gear, when the machine comes into action as before. The machine is stopped in the same manner at the end of the return course. At the point of the file, however, the boy in charge of the machine generally relieves the lever by hand, in order to regulate the force of the blow at the extreme point of the file, allowing the lever to fall when the file is finished.

One of these machines, with the attendance of a boy, will cut about four dozen 14-inch files per day, the attendance of the boy costing about 1*s.* 6*d.* The cost of the same amount of labour, by hand, is from 12*s.* to 14*s.*, according to the kind of file, and the time about two days and a half. The files cut by the machine have been tested by many parties, and found to be generally equal to the best hand-cut files. These machines may be seen in full operation at Messrs. Hetherington's, in Glasgow, where they have been working for upwards of six months.

It is considered that this construction of hammer may be adapted, with advantage, for general light forging, such as files or bolts, or any other light work where active striking is principally required,—the force of the blow being regulated on the same principle for forging as for file-cutting. The lever for regulating the blow may be brought to any position convenient for the workmen employed at the hammer, and may be worked either by foot or hand, as desired. A heavy hammer might be controlled by hand, on the same principle, and the force of the blow regulated according to the nature of the work to be done.

Mr. Ross exhibited one of the machines, and also a small model shewing the application of the principle to forging; and, in reply to an enquiry of the Chairman, he said, there were now six of the machines at work, some of which had been working for eight months; the finest cut of file yet made with them was common-smooth and second-cut, specimens of which were exhibited; but the machines were capable of cutting finer. With respect to the work produced, he thought it was not possible to indent the steel with a chisel without raising a burr; if the chisel were made bevil-edged, and struck the metal obliquely, it would necessarily drive the material forward, and, consequently, raise a burr; and the same effect must be produced in the machine, as by hand, if the chisel and blow were in the same relative direction in both cases.

The following paper by Mr. Alexander Allan, of Perth, was next read: —"*Description of an improved steam-boiler for locomotive and other engines.*"

In the improved construction of steam-boiler, forming the subject of the present paper, the external casing of the fire-box is cylindrical in form, and rivetted to the barrel of the boiler. The back end-plate is flanged round the entire circumference, and inserted into the external casing, to which it is rivetted, with the flange outwards. The back end-plate has two openings in it—the upper one for firing the furnace, and the lower one for regulating the admission of air under the furnace bars; allowing

access to the ash space for the removal of ashes, and enabling the fireman to work the damper, &c.: these openings are supplied with doors working on hinges, or sliding in grooves. At the bridge end of the boiler is a receiver, for the collection of scale and deposit; it is supplied with a cover, and also a screwed plug, to facilitate the removal of the deposit. Plugs are also provided at the end of the boiler, for allowing the deposit to be cleared out of the water space below the grate. An opening is made through the under side of the fire-box, to admit air from the exterior of the boiler, and it is supplied with a hinged or sliding damper, arranged to be worked from the foot-plate.

The fire-box is cylindrical for the greater part of its length, and enlarged at the front end to the form of the tube-plate, so as to form a combustion chamber, and at the same time admit of the greatest possible number of tubes. The front end of the fire-box may also be made bell-mouthed to the form of the tube-plate. The tube-plate and the end fire-box plate are both flanged, and rivetted to the fire-box. The fire-box is securely held and stayed in position by stays and roof girders. Inverted bridges, or water spaces, are rivetted to and suspended from the roof of the fire-box, which has holes cut in it, to allow of the admission of water to the bridges, and the escape of the steam generated in them. These bridges, besides adding to the strength of the fire-box, and giving additional heating surface, are intended to mix up the flame and smoke from the fresh fuel near the fire door, and deflect it against the red fire.

The ordinary fire bridge is made in two portions: the lower part is a hollow metallic bridge, perforated with holes to admit air; and the upper portion is made of perforated fire bricks or tiles. The air admitted by the holes in the lower part will be heated in passing through the fire brick; and, on entering the fire-box, comes in contact with the smoke and flame deflected by the bridge water spaces, upon which it acts like a series of blow-pipes. The air thus mixing with the flame in the combustion chamber, between the fire bridge and the tube-plate, causes the unconsumed gases to ignite before passing through the tubes. A hinged door is provided at the bottom of the fire bridge, with a handle to work from the foot-plate, for the purpose of letting out any ashes that may be drawn over the bridge; and a hand lever is employed for giving a slight motion to the fire bars, so that a clear fire may be maintained, and the deterioration of the bars, by burning, prevented. In locomotives the movement may be given to the fire bars by a motion taken from the axle or axle-boxes of the engine, according to convenience.

The whole of the boiler and fire-box is of wrought iron, excepting the tube-plate, which is of copper. The size of boiler is four feet outside diameter; being made cylindrical throughout, and about the same diameter as the width of the outside shell of an ordinary locomotive fire-box. The heating surface is about the same as in the ordinary boilers of the same length.

In designing the boiler above described, the object of the writer has been the combination of the following advantages:—a form and arrangement of boiler, economical in construction, possessing great strength and lightness, occupying little space, and so constructed that the parts most liable to deterioration can be removed with less labour and cost

than in ordinary boilers; having also additional facilities for clearing out the deposit, and for the consumption of smoke. With regard to locomotive boilers, a special object has been to allow of any disposition of the wheels, with a view to the best distribution of the weight; and in the boiler now described, the fire-box being contained within the cylindrical shell of the boiler, the latter can be carried further back on the foot-plate, and the trailing wheels can be placed below the fire-box.

Mr. Fairbairn enquired whether there was not some danger of burning the portion of the boiler below the ashpan, where the deposit was formed, and where there was only a narrow water space.

Mr. Allan explained that the boiler could be readily blown out at the receptacle provided there, so as to prevent accumulation of deposit at that part; and it was not exposed there to the direct heat of the fire, the ashpan being open to the air. There was less obstruction than usual from the stays around the fire-box, as they were seven or eight inches apart, instead of four inches, in consequence of the fire-box being cylindrical, without flat sides.

The following paper, by Mr. Walter Neilson, of Glasgow, was then read:—"*On an improved locomotive boiler.*"

The locomotive boiler, from the very high pressure at which steam is now used, has demanded much attention, in order to obtain a form of great strength and safety. The parallel boiler has of late years been adopted, as giving greater strength in its form, and greater durability than the raised fire-box form, which latter, although made sufficient by stays, is exposed to constantly varying expansions and strains, leading to leakage at the angles. The parallel form, however, has the objection, more particularly in large engines, where much heating surface is necessary, that the steam space is contracted or limited, besides being much occupied by stays, as well as by the steam-pipe and regulator. The water level is necessarily high in the boiler, leaving only a small segment of the circular area for the regulation of the proper water line: so that the engine driver has very little variation to work upon, between too much water and too little,—the former causing the engine to prime, and the latter involving danger of burning the fire-box or bursting the boiler.

The boiler described in the present paper is designed by the writer to obviate this defect; and for this purpose there is added, on the top of the boiler, a steam chamber, consisting of a portion of a cylinder of smaller diameter than the barrel of the boiler; the two cylinders being connected at their junction by a strong diaphragm plate, forming, as it were, a common chord to the two circles given by the section of the cylinders. By this construction a correct form is obtained, the strength of which is equal to the full resistance of the plates to the internal pressure of steam. It will be observed, that no angle iron is used in this construction of boiler, and that the strain is entirely in the direction of the plates.

In order farther to provide against the danger of explosion from overheating the roof of the fire-box, in consequence of the water getting too

low (which the writer believes is the cause of most explosions), the fire-box roof is depressed in a circular shape, whereby a more correct form of roof girder or crown stay is obtained, and one which is really the strongest that can be got to support the weight or pressure upon the roof. The ordinary parallel girder is not correct in form, the greatest strain for rupture being across the centre of the fire-box roof, where the parallel girder has the least power of resistance. In the new plan of fire-box, the circular shape of the roof also gives the plates greater power of resistance, independently of the roof girders. As an additional precaution, the top row of tubes is somewhat raised at the smoke-box end. The result of this arrangement is, that a considerably greater range of water level is obtained with perfect safety; for in case the water line gets as low as the top of the fire-box, the crown will be perfectly safe, and the top row of tubes, at the smoke-box end, will first give way; and should the water get lower, the part of the crown first exposed to be heated is the strongest portion, and will stand safely till the tubes burn and give warning of the danger. It may be objected to the depressed fire-box crown that it will be more apt to collect deposit than the flat crown; but the writer does not think there need be much apprehension on this point, as there is a free and level communication across the top of the fire-box, from side to side. It should be remarked, however, that the locomotive engine is never worked to economy with bad water; and money expended in obtaining proper water is more than compensated for in the saving on the engines, and in the safety of the boilers.

Another improvement in the boiler now described consists in an arrangement for using coal instead of coke. In the ordinary fire-box the production of gaseous matters from the coal is too rapid to obtain a proper combustion, and even if oxygen is supplied by the admission of air into the fire-box, the very great variation of temperature in the furnace, caused by every fresh supply of fuel, renders the complete combustion of the gaseous products very difficult. To get over this difficulty, the back part of the fire-box, under the door, is lined with large fire-brick blocks, having tubular openings through them, forming a communication between the interior and exterior of the fire-box; in the same manner a bridge is formed in front of the fire, with a similar series of tubular openings through it. The fire-brick blocks will become highly heated by the action of the fire, and consequently the air drawn through them will also be highly heated, ready for effecting the combustion of the gases the moment the air enters the furnace in the form of jets; they also maintain a more equal degree of heat in the furnace, at each new supply of fuel, which is of great importance. It is not thought that any difficulty need be anticipated in the fixing and maintaining of the fire-brick blocks.

The above construction of boiler is expected to afford a more steady supply of steam, and also to give the engine-driver better opportunity of working the fire with economy of fuel.

Professor Rankine said, in the unavoidable absence of Mr. Neilson, he had been requested to give any requisite explanations respecting the paper. He observed, that the principle object had been to prevent the failure of the roof of the fire-box, as the result of such an accident was very serious, and generally fatal; whilst the failure of the other portion

of the boiler (the tubes) seldom caused more than delay. He had been struck with the importance of the subject by seeing recently the result of the failure of a fire-box with a level top, where all the roof girders broke across the top, two only of the girders having been notched at that part. An exactly similar fire-box was tested with water pressure, and it was found that 470 lbs. pressure per square inch was required to make the roof give way in a similar manner, being nearly five times the working pressure; that pressure, however, must have been attained in the case of the accident referred to. The object of the plan now proposed was, both to strengthen the roof, by giving it a curved form and increasing the depth of the girders, and to protect it, by preventing it from being laid bare of water in the centre,—leaving the tubes to be first exposed when the water got low. He now suggested the slightly curving the roof in a convex form transversely, to give the deposit a tendency to clear itself at the sides.

Mr. Fenton observed, that it was very unusual for a failure of the roof girders to occur; when the roof of a fire-box had given way, it had generally come down in one piece, with the roof girders entire. The case that had been referred to was the only instance, he believed, on record of a roof failing across, and in that case there were also no stays from the roof up to the outer shell. A supplementary steam chamber, as proposed in the paper, might perhaps have some advantage, and he remembered several being so constructed, under his superintendence, for the Hanoverian Railway.

Mr. Tosh had found great difficulty in preventing an injurious accumulation of sediment on flat-roofed fire-boxes, even with $1\frac{1}{2}$-inch water spaces between the copper roof and the roof bars; any hollow form of roof must increase the evil, and he thought that such a roof would be found very troublesome in practice.

The following paper, by Mr. James Wallace, Jun., of Glasgow, was next read:—"*Description of a steam dash wheel for bleaching.*"

The object of the improvements described in the present paper is to render the dash wheel more extensively available as a bleaching and cleansing agent, for textile fabrics and other materials, than it has hitherto been.

The dash wheel, which in its general features is constructed like those hitherto in use, is mounted upon a hollow shaft, by which it is put in communication with a steam pipe. Steam is supplied through the hollow shaft into the several compartments of the wheel through perforations in the shaft. The introduction of the steam alone into the dash wheel is sufficient to improve greatly the ordinary bleaching, washing and cleansing, and "posting" effect of the wheel; but with the farther introduction of acids, alkalis, soap, and other bleaching or preparing ingredients, the dash wheel is made directly available as an excellent bleaching apparatus. The various preparations are contained in cisterns, placed above the level of the range of dash wheels, and a pipe from each cistern runs along the line of wheels, each pipe communicating with a branch pipe leading to the hollow shaft of the dash wheel,—the pipe immediately joining the hollow shaft being connected

to it by a stuffing-box joint. Each branch pipe is fitted with a valve, in order that the quantity of each ingredient, and the time during which it is admitted into the wheel, may be easily regulated. The small quantity of water required in the process is also introduced through the same pipe, from one of the branch pipes. The fluids have egress from the wheel by outlets, at or near the circumference,—the outlets being fitted with doors or valves by means of which they may be closed or opened at pleasure. The goods to be bleached are introduced into the wheel, in the usual manner, by doors in the face or side.

The rate at which the wheels are driven will depend upon their size; a wheel 6 feet in diameter must make about 24 revolutions per minute, whilst 16 revolutions per minute are sufficient for a wheel 9 feet in diameter; in other words, the velocity at the circumference is in each case about 430 feet per minute. The steam is introduced into the wheels at a pressure of from 3 to 5 lbs. per square inch above the atmosphere, and an engine working up to 5 horse power will drive a 9-feet wheel.

The system of bleaching hitherto in use, differs widely from the process at present under consideration; the former is confined exclusively to what may be termed the quiescent or inactive system,—the goods operated upon merely undergoing the change of a removal from one steeping process to another, with little or no agitation beyond that due to the boiling action. In the new process, the fabrics to be bleached are at once placed in the rotating wheel, the chemical agents are introduced into the wheel, and the steam is turned on. During the rotation of the wheel, the goods are subjected to a motion which is continually effecting a series of changes in their position, and greatly accelerates the cleansing action.

Various classes of goods may be thus treated, from the heaviest description of cotton or flax manufactures to the most fragile laces, without the slightest injury to the fabric. Perhaps what are termed sewed muslins or embroidered goods are the most difficult to bleach, from the almost indelible character of the ink, grease, and other extraneous matter imbibed in the process of manufacturing, in connection with the delicate nature of the material. The writer, as a manufacturer and bleacher of these goods, has had ample opportunity of fully testing this invention, which he has exclusively adopted for the last eighteen months. One of the most extensive bleaching firms of this class of goods in Scotland—Messrs. Cochrane and Armour, of Neilston,—have also discarded their old process, and adopted the new one. By the old system, sewed muslins take thirty days, on an average, before they are returned by the bleacher, whilst, with the new process, they can be regularly finished in three days; and besides this great saving of time, there is also a great advantage from the fact that as much as 50 per cent. less of chemicals, soap, fuel, and labour is required with the steam dash wheel. For linens this invention is invaluable, as it has been proved beyond doubt that the heavy linens and damasks made in the north of Scotland and Ireland, can be bleached in one-twelfth of the time, and at considerably less expense, by the dash wheel; whilst none of the large tracts of ground at present occupied for grass bleaching, will in future be required for this purpose, but may be all taken up for agricultural uses. Calicoes are bleached by this process

at Messrs. Ormerod and Co.'s works, near Manchester, in six hours; whereas, by the old process, the time required to bleach these goods is nearly as many days. The steam dash wheel may in fact be said to contain in itself a complete bleachwork.

The steam dash wheel is also of great advantage to paper makers, as an apparatus for removing the dirt and colour from the rags. Cotton waste, after having been used by engineers, has been cleansed and whitened, and made fit for use again in less than four hours. As a washing apparatus for clothes, it has many advantages, as a single wheel will do the work of 200 washerwomen.

The following paper, by Mr. William Gorman, of Glasgow, was next read:—"*Description of an improved water meter.*"

The meter forming the subject of the present paper is thought by the writer to include most of the well known, but as yet only partially attained, requirements of a water meter.

The meter consists of a casing, containing a vane wheel, driven round by the water, which is admitted at the circumference of the wheel, in a direction tangential to the circle described by the vanes, and drawn off from the centre. The openings for the supply of the water are regulated by self-acting loaded valves, which contract the orifices when the flow is small, opening at all times only to an extent proportioned to the quantity of water passing through; and thus preventing the stream from becoming too feeble, on account of its small velocity, to move the vane wheel. The vane wheel acts in the same manner as a light body, free to move, introduced into a pipe containing water. If the floating substance did not come into contact with the inside of the pipe, it would move just as fast, and as far as the water in the pipe. The sectional area of the pipe being known, the quantity of water can be determined by the distance the floating substance has moved in the pipe. Similarly, in the present case, the quantity of water passing through the meter is measured by the velocity of revolution of the vane wheel, the sectional area of the inlet or outlet pipe being known.

The meter above described is accurate in measurement under all circumstances which occur in practice; and as the measuring chamber and apparatus are not subject to wear, its accuracy must be permanent. Whatever pressure of water is supplied can also be nearly obtained after the water has been measured. The meter works smoothly and uniformly, and moves with equal power through every part of its revolution, as there are no dead points; and the water is delivered in a smooth uninterrupted stream. All the working parts are free from each other, none of them requiring to be in contact. The vane wheel may be kept as free from the case as is desirable, since the measurement does not depend on the size of the wheel, but on the capacity of the measuring chamber and the velocity of revolution of the wheel.

This meter was first experimented on when the Gorbal's Gravitation Company offered a premium for a water meter to work under pressure; and although the machinery was very imperfect, the results obtained were amply sufficient to establish the accuracy of its action. The meter was tested under pressures ranging from upwards of 200 feet head to less

than an inch, the flow of water being reduced to ½ gallon per minute. The meter was correct at all important runs, and even when the smallest quantities were being drawn off, the variation in measurement did not exceed 2½ per cent.

In the meter with which the experiments were made, the regulating valves were not properly placed in relation to the vane wheel, and consequently the registration was deficient when minute quantities of water were passing through the meter. This objection has been completely obviated in subsequent meters, and there is now no difficulty in regulating the flow of the water, by means of the adjusting screws and weights of the regulating valves, so as to render the indications correct under all pressures.

With reference to durability, it may be stated that these meters have been going regularly in Glasgow for upwards of four years; and they have never had to be returned, except in one instance, where the case was too small, and consequently got choked with debris. Although the meter went for more than the time guaranteed, still, as the case was too small, it was exchanged.

It has been thought that the quick-going wheel in this meter would wear the soonest; but, on the contrary, it has several times been found in practice that the teeth of the slow moving wheels have been stripped, in consequence of the spindle which carries the indication through the meter case to the outside, getting jammed, when the fast moving wheels which did the damage, were not perceptibly worn.

Except in the cases referred to, the writer has had no personal experience of the practical working of these meters; they are all tested before being sent away, and he has never heard of any being found to vary in their indication, or get worn out.

Mr. Gorman exhibited a specimen of the meter in operation, with a glass cover to the case, so as to shew the action of the meter in working.

Professor Rankine had lately tried some experiments on the meter that had been described, which were not quite completed, but the result, so far, was satisfactory. Two quantities, of 100 gallons each, had been passed through, at the rate of 7 gallons per minute, and the meter was found to register, in one instance 99, and in the other 99½ gallons, or from ½ to 1 per cent. in defect; and again, 20 gallons had been tried, at the average rate of only 2 gallons per minute, when the meter was found equally accurate. The water was measured in a 10-gallon vessel, which would be more accurate than a 1-gallon measure for the experiments.

Mr. Siemens had paid much attention to water meters for a long time, in endeavouring to obtain a satisfactory construction. The great variety of meters might be all classed either as impact or reaction meters, measuring by the velocity of the current; or as diaphragm or piston meters, measuring by capacity. The meter that had been described in the paper belonged to the former class, which he considered the more accurate in principle. From his own observations, he believed that piston meters were liable to pass even more water without registration than the other class, after having been in use for a length of time, as it was impossible to keep the valves all in such perfect order

that they would prevent loss of water, and still not impede the action of the meter by causing too much friction. He did not think the meter that had been described differed much in principle from others that had been tried and not found satisfactory. The only complete trial of a meter, to test it thoroughly, was to let it work for a considerable length of time where the water was impure; and, under such circumstances, he thought the present meter would be found to choke with calcareous deposit, which would obstruct the working. In his own experience he had had to remove all the wheel work and spindles from the action of the water, and place them in a separate chamber, effectually protected from the water. The experiments should also be varied between the extremes of pressure and velocity of discharge, from a head of 300 feet down to a few inches pressure only, and from running full bore to the smallest stream, such as was produced by the mere leakage of a cock. Many meters, that were correct under ordinary circumstances, were found to fail under the extreme cases to which they were liable to be exposed in actual work.

Professor Rankine said, that in the experiments he had tried, the velocity of discharge was varied as much as 10 to 1, by partially closing the cock, in order to test the accuracy of measurement, and it was found to be still correct; there had not been, however, any opportunity of trying the effect of variations of pressure.

Mr. Gorman observed that all meters which measured by the velocity of a current, would be found to indicate in excess at high velocities, or lose at small runs. He had applied the regulating valves in the present meter to obviate this objection, by diminishing the area of the flow, and thereby increasing its force when discharging very slowly, and he considered they answered the purpose effectually. With regard to placing the wheel-work entirely out of the water, he had not experienced any difficulty in Glasgow, where the water was not so clean as in many other places, and he did not think any objection was to be apprehended from that cause. The only accidents that had occurred were from the spindle which passed outside the meter getting retarded; when it was invariably found, that although the teeth were stripped off the slow-moving wheels, the teeth of the quick-moving wheels were not perceptibly worn,—pointing to the great advantage of doing work at high speeds.

At the meeting held at the Society's house, New Hall-street, Birmingham, November 5th, 1856, the following papers were read:—"*Description of the ventilating fan at the Abercarn Collieries.*"

THE mode of ventilation that is still generally used in the collieries of this country, is the old furnace ventilation, where the required current of air through the mine is maintained by the rarefaction of the column of air in the ascending shaft, by means of a large fire kept constantly burning at the bottom of the shaft. In Belgium and France, on the contrary, this plan is almost superseded by the use of machinery to maintain the current of air; as the furnace ventilation, although possessing the important advantages of great simplicity, and freedom from liability to derangement from disturbing causes, has some serious objections and deficiencies; and in some cases becomes so imperfect a pro-

vision for ventilation, as to render a better system highly desirable, and even necessary.

The author of the present paper having occasion to ventilate the workings in some extensive and very fiery coal seams recently won at Abercarn, in South Wales, under circumstances where the furnace ventilation could not be applied, after carefully collecting every accessible information as to the ventilating machines used in Great Britain and on the Continent, came to the conclusion that a plan of machine proposed for the purpose, some years since, by Mr. James Nasmyth, would be the most suitable and effective. After consultation with Mr. Nasmyth, it was resolved to test the principle and plan by actual practice; and the ventilating fan described in the present paper was made at Patricroft, by Mr. Nasmyth, and is erected and now working at the Abercarn Collieries.

The fan is 13½ feet diameter, with 8 vanes, each 3 feet 6 inches wide and 3 feet long. It is fixed on a horizontal shaft, 8 feet 7 inches in length from centre to centre of the bearings, which are 9 inches long, by 4½ inches diameter. The vanes are of thin plate iron, and carried by forked wrought-iron arms, secured to a centre disc, carried by the shaft. The fan works within a casing, consisting of two fixed sides of thin wrought plate, entirely open round the circumference, and connected together by stay rods. The sides are 3 inches clear from the edges of the vanes, and have a circular opening, 6 feet diameter, in the centre of each, from which rectangular wrought-iron trunks are carried down for the entrance of the air; the bearings for the fan-shaft being fixed in the outer sides of these trunks, which are strengthened for the purpose by vertical cast-iron standards. The two air trunks join together below the fan, and communicate with the pit by means of a horizontal tunnel which enters the pit at 21 feet depth from the top. The fan is driven by a small direct-acting non-condensing engine, fixed upon the face of one of the vertical cast-iron standards, and connected to a crank on the end of the fan-shaft. The steam-cylinder is 12 inches diameter and 12 inches stroke, and is worked by steam from the boilers of the winding-engine of the pit, at a pressure of about 13 pounds per square inch. The eccentric for the slide valve is placed just inside the air trunk, and works the valve through a short weigh-shaft, with a lever on the outside.

The pit is of an oval form, 10 feet by 18 feet, and divided near the centre by a timber brattice,—the one side forming the upcast shaft, and the other the downcast. Both of these are used for winding, and the cages in which the trucks, &c., are brought up, work between guides fixed to the timbering of the pit. The pumps are placed in the downcast shaft. To allow of the upcast shaft being used for winding, the top is closed by an air valve, which is formed by simply boarding up the underside of the ordinary guard upon the mouth of the shaft, leaving only the hole in the centre, through which the chain works. This air-valve is carried up by the cage on arriving at the top of the shaft, and then drops down again flat upon the opening when the cage is lowered. During the time that the valve is lifted, its place is occupied by the close bottom of the cage, which nearly fills the rectangular opening left at the top of the shaft. By this simple means the top of the upcast shaft is kept practically closed; for the leakage of air downwards through the

top, whilst the cage is in the act of opening or closing the air valve, and through the small area that always remains open, is found to be quite immaterial, and the surplus ventilating power of the fan is amply sufficient to provide against it.

The total depth of the pit is nearly 300 yards, and at a depth of 120 yards a split of air is taken off, and coursed through workings from which coal and fire-clay are got; the larger portion of the air descends to the bottom of the pit, and is there split into many courses, to work two separate seams of coal, and a vein of ironstone. The total length of road laid with plates or rails in the workings is about 7 miles, and the working faces amount to nearly double that distance. The longest distance that is traversed by any single course or split of air, in passing from the downcast to the upcast shaft, is nearly 2 miles. The quantity of materials raised from the pit is about 500 tons daily.

The speed at which the ventilating fan is usually worked is about 60 revolutions per minute, giving a velocity at the circumference of the fan of 2,545 feet per minute; 45,000 cubic feet of air per minute are then drawn through the mine, nearly one-third of which ventilates the upper workings, and the rest passes through the lower workings.

A table appended to the paper gives the results of a series of experiments made with this ventilating fan, under the direction of the author, by Mr. R. S. Roper,—shewing that the quantity of air delivered at the velocities of 60 and 80 revolutions of the fan per minute is 45,000 and 56,000 cubic feet per minute, with a velocity of current of 782 and 1037 lineal feet per minute respectively, or about 9 and 12 miles per hour; and the degree of vacuum or exhaustion in the upcast shaft is ·5 and ·9 inch of water respectively.

In these experiments the mode adopted for ascertaining the velocity of the air currents, was by calculation from the difference of pressure, as observed by means of a carefully constructed vacuum gauge, the result being checked by the anemometer, and by the time of passage of the smoke of powder, fired at fixed distances, by means of wires from a voltaic battery at the top of the shaft. The working velocity of the fan is readily and instantly regulated by means of a throttle-valve in the steam-pipe of the engine, which is under the control of the man in charge of the working of the pit, and is adjusted according to the requirements of the ventilation arising from changes in the atmospheric pressure, and in the quantity of gas in the workings. It has been found that a velocity of about 50 to 60 revolutions per minute gives the best amount of ventilation, and that beyond 80 revolutions the current of air is too strong to allow of the lamps being kept alight in the workings.

This ventilating fan has been now in constant work for two years, night and day, without once stopping for repairs of any kind, and is in as good working order as when first started; there appears to be nothing to get out of order about the machine, on account of the simplicity of its construction, and no reason to anticipate any failure. The engine is made very simple in construction, with large and durable wearing surfaces, and the steam cylinder is fitted with a solid metal piston, to prevent any occasion for stopping to adjust the packing. The whole cost of the steam power for working the fan is so insignificant, that a little leakage of steam is quite immaterial.

The ventilating fan has a very important advantage over the furnace

ventilation, in the power it affords of suddenly increasing the current of air to a great extent in any emergency; whilst, with the furnace, any increase is very slow in action and limited in extent, and cannot be effected from the surface of the ground.

Another advantage is the coolness and freshness of the upcast shaft, which can be used for the passage of the men as freely as the downcast shaft, being free from the heat and smoke of the furnace ventilation. There is also no risk of explosion from the access of gas to the furnace fire; and in the first opening of a fiery seam, as in the present case at Abercarn, a furnace could not have been safely lighted until after a long delay for drainage off the gas, owing to the sudden and extensive liberation of gas; and even then it would have been attended with considerable difficulty and danger; but with the help of the fan all delay and danger was avoided, and the workings commenced immediately on reaching the seam.

A bratticed shaft was the only plan practicable in the present case, on account of the great difficulty of sinking deep through the rock, which was of remarkable hardness; and in such cases the furnace ventilation is very objectionable on account of the constant leakage caused by the drying of the timber of the brattice from the effects of the heat of the fire, and the corroding action of the sulphurous vapours of the furnace smoke.

In the pit at Abercarn, the quantity of gas is so serious that safety-lamps are now used exclusively throughout the workings, and not a single naked light is allowed, except at the two stations near the shaft, where the safety-lamps are lighted and locked up. Several very slight explosions have occurred, but not any at all serious in their consequences, except one, which may be mentioned as a useful example of the great practical value of the means of suddenly producing a greatly increased current of ventilation, in preventing loss of life from the result of explosion. In this instance, which occurred about October, 1855, one of the men took a naked candle into a stall in which fire damp had accumulated in the lower workings, at about 150 yards distance from the shaft. An explosion ensued, which was heard by the author, who was at the top of the shaft at the time, and he instantly turned the steam full on to the engine of the fan, which immediately increased the speed of the fan to nearly double its rate, and caused such a sudden increase in the velocity of the current of ventilation, that the after-damp resulting from the explosion was carried past the men in the workings so quickly that they escaped all serious injury, so momentary was their exposure to its effects. But if the ordinary velocity of current only had been maintained, some of these men could not have escaped with their lives. The man who caused the explosion was severely burnt, but recovered from the injury.

Almost immediately after turning on the steam to the fan, a shower of black particles was thrown out of the fan, which would be the result of the explosion, being the fine particles of carbon, liberated as light flaky soot from the decomposition of the carburetted hydrogen by the explosion. This is commonly but incorrectly called "coal dust," and is always the result of an explosion; and, in the author's opinion, this is the cause of the fatal effect of the after damp, from the accumulation of the minute solid particles upon the lungs, and not the exposure to the

carbonic acid and nitrogen resulting from the combustion of the gas and air. This opinion is confirmed by the result of examination of the lungs of men killed by mine explosions, which are found to be loaded with these black solid particles. It has been observed frequently that men can live for some time in the after-damp following a mine explosion, if they take the precaution to cover their mouths and nostrils completely with a handkerchief, so as to sift the air they breathe and prevent these floating particles of carbon from entering the lungs; and this precaution is enjoined in the rules of several mines, to prevent breathing the "coal dust," as it is termed.

A similar ventilating fan to that above described has been since erected, by Mr. Nasmyth, at Skiar Spring Colliery, near Elsecar, which is working with complete success; it is of rather larger size than the one at Abercarn, being 15 feet diameter, and 4 feet 3 inches wide in the vanes, and is worked at 80 revolutions per minute by the steam from a pumping engine boiler, at 15 lbs. per square inch. The result is a thoroughly efficient ventilation of the workings, completely under control at the surface of the ground, and maintained at an expenditure of fuel extremely small as compared with that required for the ordinary furnace ventilation.

PROVISIONAL PROTECTIONS GRANTED.

[*Cases in which a Provisional Specification has been deposited.*]

2172. James Joseph Cardin, of Orange-street, Red Lion-square, for improvements in brakes for omnibuses.—[*Dated August 15th.*]

2214. Amos Pierce Chamberlain, of Rue Royale, Paris, for improvements in machines for cutting corks and other substances.—[*Dated Aug. 20th.*]

2227. Henry Hodges, of New York, for improvements in the manufacture of gunpowder.—[*Dated August 22nd.*]

[*Cases in which a Provisional Specification has been deposited.*]

1444. Edmund Whitaker, of Rochdale, Lancashire, Alfred Law, of Littleborough, in the same county, and James Fletcher, of Little Clegg, near Littleborough, for improvements in steam-engines.—[*Dated May 22nd.*]

1710. Stanislas Tranquille Modeste Sorel, of Rue de Lancry, Paris, for new chemical compositions, producing either house paintings, cement, or plastic paste to be moulded.—[*Dated June 19th.*]

1870. John Smith, of Bradford, Yorkshire, for improvements in flour-dressing machines.—[*Dated July 4th.*]

1980. Charles Barlow, of Chancery-lane, for an improved brick-making machine,—being a communication.—[*Dated July 17th.*]

2024. Charles Frédéric Vasserot, of Essex-street, Strand, for an apparatus for moulding candles,—being a communication.—[*Dated July 23rd.*]

2042. Augustin Mortera, of Paris, for improvements in coupling carriages on railways.—[*Dated July 27th.*]

2060. Pierre Alexis Francisse Bobœuf, of Paris, for improvements in preserving and otherwise treating animal and vegetable substances, and in the purification of oils employed therein, and which may be used for other purposes.—[*Dated July 28th.*]

2084. Isaac Moll, of Cologne, for an economical fire regulator.—[*Dated July 31st.*]

2112. William Colborne Cambridge, of Bristol, for improvements in the con-

struction and working of endless travelling railways.

2113. William Colborne Cambridge, of Bristol, for improvements in press wheel rollers or clod crushers.

2114. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in umbrellas and parasols,—being a communication.

The above bear date August 4th.

2115. John Littlewood, and Albert Schlumberger, both of Church, near Accrington, for improvements in producing printed or dyed colors from murexide on woollen fabrics or yarns or mixed fabrics, or yarns of wool and cotton.

2116. Sebastien Botturi, of Paris, for an apparatus and oven for the carbonization and distillation of all animal and vegetable matters.

2117. Sebastien Botturi, of Paris, for the making of moveable chairs and seats of every kind and description, to be called "Botturi's moveable chairs and seats."

2118. Thomas Lyne, of Malmesbury, for an improved field stile or gate.

2119. Thomas Field, of Spring-place, Kentish Town, for effecting improvements in parasols and umbrellas.

The above bear date August 5th.

2120. Samuel Middleton, and John Lowes, both of Southwark, for improved apparatus for the extinction of fire in buildings.

2121. Sebastien Botturi, of Paris, for a system of weaving for the manufacture of all kinds of textile goods, viz., shawls, silk stuffs, carpets, knotted or unknotted, single or double-faced Gobelins tapestry, drapery, velvets, damasked linen, and various other articles, by means of a frame, which replaces the Jacquard loom.

2122. Alexander Dalgety, of Manchester, for improvements in rotary engines and pumps.

2123. Daniel Jones Crossley, of Hebden-bridge, Yorkshire, for improvements in the treatment of certain textile fabrics called "pellones," and used for saddle covers, and in the machinery or apparatus for effecting the same.

2124. Ellis Rowland, of Manchester, for certain improvements in steam-engines.

2125. William Gilmour, of Dalbeth, Lanark, N.B., for improvements in obtaining motive power.

2126. Thomas Lawley, of Wolverhampton, for improvements in ornamenting articles made of tin-plate and of other bright metals.

2127. John Parker, of Ivy House, Bradford, Yorkshire, for improvements in the means of supplying or feeding steam-boilers with water, whereby a great saving of fuel is effected.

The above bear date August 6th.

2128. Berthold Lowissöhn, of Fenchurch-street, for an improvement in the manufacture of soap.

2129. John Bradley, of Radcliffe, Lancashire, for certain improvements in machinery or apparatus for engraving metallic cylinders or rollers, employed for printing calico and other surfaces.

2130. John Robinson Scartliff, of Wolverhampton, for certain improvements in mathematical instruments.

2131. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in mules for spinning,—being a communication.

The above bear date August 7th.

2132. Thomas George Shaw, of Dartmouth-row, Blackheath, for improvements in washing and wringing machines.

2133. William Irving Holdsworth, of Shaw Lodge Mills, Halifax, for improvements in weaving woollen damasks,—being a communication.

2134. John Langford, and Joseph Wilder, both of Birmingham, for improvements in signals and alarums.

2135. Isaac Oschinsky, of Old Broad-street, for an improved soap to which he gives the name of "rheumo-arthritii soap."

2136. George Collier, William Noble, and Ward Holroyd, all of Halifax, Yorkshire, for improvements in cutting, shaping, and planing wood, and in the tools and apparatus employed therein.

2137. John Anderton, Jonas Foster Rushworth, and Joseph Benn, all of Queenshead, Yorkshire, for improvements in machinery for moulding, cutting, and carving wood and stone.

The above bear date August 8th.

2138. Thomas George Shaw, of Dartmouth-row, Blackheath, for improvements in machinery for thrashing and separating wheat and other grain.

2139. James Bertram, of Edinburgh, and John Louis Jullion, of Foots Cray, for improvements in the manufacture of paper.

2140. John Roberts, jun., of Whitechapel-road, for improving the combustion of fuel, and preventing the escape of fuliginous smoke from shafts and flues.

2142. Antonie Tremeschin, of King-street, Snow-hill, for improvements in curling tongs.

2143. Amberst Hawker Renton, of Buckingham-street, Adelphi, for improvements in apparatus for steering vessels,—being a communication.

2144. Peter Augustin Godefroy, of King's Mead Cottages, New North-road, for an improved method of desulphurizing mineral-matrix, for the extraction of auriferous, argentiferous, and other metals contained therein.

The above bear date August 10*th.*

2145. George Chambers, of Cheapside, for improvements in separating cinders from ashes and economizing fuel.

2146. Alexander Lang, of Kinniel Iron Works, Linlithgow, for improved machinery for feeding steam-boilers.

2148. William Lyell Groundwater, of Bridge-street, Greenwich, and Henry Prince, of the Grove, Southwark, for improvements in pumps.

2149. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in pickers for looms,—being a communication.

The above bear date August 11*th.*

2150. Thomas Hardcastle, of Bradshaw, near Bolton-le-Moors, for improvements in machinery for washing textile fabrics.

2151. Robert Wagstaff, of Mottram-in-Longendale, Cheshire, for certain improvements in machinery or apparatus for digging land.

2153. William James Cantelo, of Southwark, for improvements in the preservation of vegetable matters.

2154. William Alexander Clarke, of West Malvern, for improvements in the construction of and mode of applying hot-air and vapour baths.

The above bear date August 12*th.*

2155. William Pratchitt, and Samuel Horrocks, both of Bolton-le-Moors, for improvements in apparatus to regulate the pressure of fluids, and to compensate for the expansion of steam and hot-water pipes.

2156. Henry Collingridge, of Oxford, for improvements in separating metallic substances from coffee, and in the apparatus employed for the purpose.

2157. Robert M'Adam, of Baldoon, near Kirkinner, N.B., for improved apparatus to be employed in making cheese, and in drawing off liquids.

2158. William Smith Wheatcroft, and James Newton Smith, both of Manchester, for improvements in valves and the chambers connected therewith, applicable to hydrants and taps for the supply of water and other fluids.

2159. John Alleyne Bosworth, of Humberstone, Leicestershire, for improvements in machinery for grinding and crushing clay and brick earth.

2160. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in sewing needles,—being a communication.

2161. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for cutting files,—being a communication.

2162. James William Benson, of Ludgate-hill, for improvements in the construction of bows or handles of watches, lockets, eye-glasses, and other articles requiring such appendages.

2163. Thomas Eade, of Ipswich, for an improved breech-loading fire-arm, and projectile to be used therewith.

The above bear date August 13*th.*

2164. John Parkinson, of the Victoria Works, Bury, Lancashire, for improvements in the construction of pressure and vacuum gauges.

2165. Paul Emile Laviron, of Paris, for improvements in apparatus for curing smoky chimneys, and for increasing the draft in them.

2166. John Tickle, of Westbromwich, for improvements in metallic pistons for steam and other cylinders.

2167. Charles Gumm, of Change-alley, Cornhill, for improvements in the

construction of boats,—being a communication.

2168. Frederick Lipscombe, of the Strand, for improvements in the mode of diverting the London sewage from the River Thames, and in discharging it into the sea.

2169. Samuel Draper, of Lenton, near Nottingham, for improvements in the manufacture of handles and fastenings for doors of railway and other carriages.

The above bear date August 14*th.*

2170. Samuel Clift, of Manchester, for improvements in the purification of certain gases, and in the application of their products to the manufacture of alum.

2171. William Smith, of Manchester, for improvements in making soap.

2173. Auguste Joseph Aucher, of Paris, for improvements in elastic tissues for ladies' petticoats and other similar articles.

2175. William Stettinius Clark, of High Holborn, for improvements in hay and hop presses; the same being applicable to compressing other substances of a similar nature,—being a communication.

2176. John Coope Haddan, of Cannon-row, for improvements in the construction of railways, and of the carriages to be used therewith or thereon.

2177. John Buckley, and Thomas Wrigley, both of Carr-hill, Saddleworth, Yorkshire, for improvements in self-acting mules or machines for spinning and doubling.

2178. Hubert Pirotte, of Liége, Belgium, for improvements in the construction of lathes for boring and turning.

The above bear date August 15*th.*

2179. Archibald Smith, of Princes-street, Leicester-square, for improvements in machinery for, and in the method or methods of, making wire ropes.

2180. John Abraham, of Birmingham, for a new or improved gauge for gauging wire and sheet metal, and for other like purposes.

2181. Richard Talbot, of Blackburn, and Benjamin Croasdale, of Witton, near Blackburn, for improvements in looms.

2182. Peter Carmichael, of Dens Works, Dundee, for improvements in calendering and mangling cloth.

2183. Richard Hoe, of Leadenhall-street, for improvements in bullion boxes, and in boxes used for carrying other valuable commodities.

2184. François Xavier Poznanski, of Craven-street, Westminster, for an improvement in instruments for ascertaining and indicating the state of the pulse, which improvement is also applicable to other instruments in which fluids are required to circulate or work in tubes of small bore.

2185. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the valve arrangement of steam and other engines,—being a communication.

2186. John Grist, of Islington, for improvements in mash tuns and in apparatus to be employed therewith, which apparatus is also applicable to the heating and keeping up of a continuous circulation of liquids in any vessel to which it may be connected.

2187. Charles Reeves, of Birmingham, for improvements in the manufacture of knives.

The above bear date August 17*th.*

2188. Joseph Coupe, of Preston, Lancashire, for improvements in power looms.

2190. William Henry Miller, and Henry Edward Skinner, both of Shadwell, for improvements in rotary engines and pumps.

2191. Charles Nightingale, of Wardour-street, Soho, for improvements in, and applicable to, machines for tearing or reducing rags and other fabrics.

2192. Benjamin Lupton, Robert Jackson, Daniel Dean, and John Holden, all of Burnley, Lancashire, for certain improvements in power looms for weaving.

2193. William Young, of Queen-street, City, for improvements in fire-places or stoves.

2194. Thomas Keddy, of Handsworth, Staffordshire, for new or improved machinery for the cultivation of land.

The above bear date August 18*th.*

2195. Sigismond Rosenthal, of Red Lion-square, for printing on both

sides of a sheet of paper by a single impression on an ordinary lithographic or other press.

2196. Samuel Bottomley, James Bottomley, and Thomas Bottomley, all of Buttershaw, Yorkshire, for improvements in machinery acting upon, and in connection with, rotary shuttle boxes, for weaving checks, plaids, figured and fancy goods.

2197. Arthur Wall, of the East India-road, Poplar, for improvements in amalgamating metals.

2198. Arthur Wall, of the East India-road, Poplar, for improvements in coating metallic surfaces.

2199. Alexis Jean Dessales, of Paris, for an improvement in lamps for railway carriages, ships' cabins, and other oil lamps.

2200. Pier Alberto Balestrini, of Brescia, Italy, for a new method of, and apparatus for, sounding at sea and in other waters.

2202. Charles Frédéric Vasserot, of Essex-street, for a smoke-consuming grate,—being a communication.

2203. Edward Lund, of Manchester, for improvements in cocks, valves, pumps, and water plugs.

2204. Ferdinand Potts, of Birmingham, for certain improvements in the mode of cutting-out, forming, and finishing certain descriptions of metallic tubes, part of which is also applicable for other such like purposes.

2205. William Hartley, of Bury, Lancashire, for improvements in steam-engines and steam-boiler apparatus.

2206. Robert Clark Gist, of Cannon-street, London, for improvements in the manufacture of manure,—being a communication.

2207. Franz Ruff, of Gray's-inn-road, and Maximillian Gutkind, of Noble-street, for machinery or apparatus for folding and measuring fabrics, and registering the same.

2208. James Murdoch Napier, of Vine-street, York-road, for improvements in apparatus for paying out submarine telegraph cables.

The above bear date August 19th.

2209. Robert Lawrence Brooke, of Keppel-street, Russell-square, for improved method for discharging, "paying out," and submerging electric telegraph cables, wires, or ropes, or such like articles from ships or vessels of any description.

2210. Theophilus Gough, and Joshua Margerison, both of Bristol, for improvements in braking apparatus for vehicles used on railways, or on other roads or ways; parts of which are applicable for communication between guards and drivers of trains.

2211. John Gedge, of Wellington-street, Strand, for improved means of heating buildings and of facilitating the escape of smoke and gases therefrom,—being a communication.

2212. Richard Archibald Brooman, of Fleet-street, for a new method of defecating sugar and other saccharine matters, and of refining or rectifying alcohol,—being a communication.

2215. Robert Taylerson, of Tryons-terrace, Hackney, for an improvement in metal ships and vessels.

2216. Daniel Messmore, of New York, for an improved method of dressing mill-stones for hulling rice and other grain having hulls or husks,—being a communication.

2217. Thomas Ingram, of Bradford, Yorkshire, for improvements in railway breaks.

The above bear date August 20th.

2218. William Kemble Hall, of Cannon-street, for improvements in apparatus for measuring and registering the speed and leeway of ships, and indicating the distance accomplished, —being a communication.

2219. Joseph Glover, and John Bold, both of Liverpool, for an improved material for transfer printing.

2220. John Mc Master, of Caldons, Stoneykirk, and William Wilson, of Whithorn, both in the county of Wigtown, for manufacturing liquid farm manure, and rendering it as efficient as any artificial manure, at a small expense to the farmer.

2221. Victor Hippolyte Laurent, of Plancher-les-Mines, France, for a new improved machine for forging nails and other similar articles.

2222. Peter Ashcroft, of Richmond-house, Dalston, for alarm signals for the prevention of accidents on railways.

2223. Henry Cartwright, of the Dean,

Broseley, Shropshire, for improvements in the construction of steam-engines.

2224. John Dauglish, of Great Malvern, for improvements in the preparation of dough.

2226. Henry Clarke, of Chancery-lane, for improvements in the lines of steam vessels, and in the method of propelling the same.

The above bear date August 21st.

2228. Henry Dircks, of Moorgate-street, for an improved fire-escape,—being a communication.

2229. George Steell, and William Steell, of Kew-road, Richmond, for the better construction of a double-backed double boiler for heating with hot water, churches, horticultural buildings, mansions, theatres, &c., &c.

2230. Frederick Albert Gatty, of Accrington, Lancashire, for improvements in the manufacture of chlorine and sulphuric acid.

2231. Thomas Settle, of Bolton-le-Moors, for certain improvements in looms for weaving.

2232. John Pinchbeck, of Katesgrove Iron Works, Reading, for an improvement in screens for dressing or separating corn or other grain.

2233. Ludvig Levison, of Birmingham, for improvements in mechanical purchases, to be employed for hoisting purposes, and for extracting roots and stumps of trees,—being a communication.

2234. Perry G. Gardiner, of New York, for a new and useful process in the treatment of cast-steel while passing from the molten state into that of being hardened or tempered, and which, with certain variations, is applicable to the making of tools, instruments, axes, wheels, or ingots.

The above bear date August 22nd.

2235. François Jules Blanc, of Paris, for an improved tire for the wheels of railway carriages, engines, and tenders.

2236. George Daniel Davis, of St. Leonard's-road, East India-road, for improvements in the construction and in the method of working windlasses.

2237. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in temples for looms,—being a communication.

2238. Thomas Rickett, of the Castle Foundry, Buckinghamshire, for improvements in machinery for sowing seeds and manure.

2239. Alfred Hamilton, of Oxford-square, Middlesex, for improvements in the construction of, and in mooring, buoys, beacons, floating lights, and other floating vessels and bodies.

2240. Samuel Fox, and Julian Wilfred Slater, both of Sheffield, for an improved metallic compound, applicable to the manufacture of various useful articles.

The above bear date August 24th.

2241. Thomas Macauley, of Shoreditch, for improvements in apparatus for condensing the noxious vapours arising from varnish-making and other like manufactures.

2242. Francis Preston, of Manchester, for certain improvements in apparatus to be applied to the spindles of machines for preparing, spinning, and doubling cotton and other fibrous materials.

2244. Edward Riley, of Droylsden, near Manchester, for improvements in looms.

2245. George Wirgman Hemming, of Belsize-road, St. John's Wood, for improvements in apparatus employed in delivering submarine telegraph cables from ships.

2246. Charles Clement James, of Norwood Green, for improvements in propelling vessels.

2247. William Nicholls, of Chippenham, Wilts, for an improved apparatus for warming milk.

2248. Henry Parry, of Croydon, for improvements in the construction of rails for railways or tramways.

2249. James Ronald, of Liverpool, for improvements in laying or depositing submarine telegraph cables.

2250. John Penn, of Greenwich, for an improvement in apparatus for taking the thrust of screw and submerged propellers.

2251. John Jervis Tucker, of Sheerness, and George Blaxland, of H.M. Dockyard, Sheerness, for improvements in steam-boiler and other furnaces.

2252. Werner Staufen, of Baker-street, for an improved method of treating

Agava Americana, or Mexican grass, and the manufacture of a new fabric therefrom.

2253. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in machinery for preparing, roving, spinning, and twisting fibrous substances,—being a communication.

2254. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for a mode of varying the length and reversing the direction of the throw of exeentrics, applicable to the reversing gear of locomotives, and expansion gear of other steam-engines, and to other purposes,—being a communication.

2255. Philip Hill, of Manchester, and John Moore, of Salford, for certain improvements in machinery or apparatus for cutting velvets or other similar piled fabrics.

The above bear date August 25th.

2256. John Gedge, of Wellington-street South, Strand, for improvements in the manufacture of soap,—being a communication.

2257. Thomas Forsyth, of Manchester, for improvements in machinery for raising, lowering, traversing, and compressing.

2258. William Hargreaves, of Bradford, Yorkshire, for improvements in screw gills for preparing wool and other fibrous substances.

2259. Thomas Smith, of Manchester, for improvements in machinery or apparatus for embossing woven fabrics, paper, leather, and other materials.

2260. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for kneading dough,—being a communication.

2261. Henry Elvin, of Castle Acre, Norfolk, for improvements in governors for steam and other engines.

2262. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improved means of operating slide-valves for the induction and eduction of steam in reciprocating steam-engines,—being a communication.

2263. James Goodwin, and Andrew Boyd, both of Milton, Stirling, N.B., for improvements in cleansing printed cotton and silk fabrics from coloring matters.

2265. Thomas Brown, of Fenchurch-street, for improvements in machinery for raising and lowering weights.

The above bear date August 26th.

2266. John McIsaac, of Manchester, for a machine or apparatus for washing or churning.

2267. William Harling, John Matthew Todd, and Thomas Harling, all of the Calder Foundry, Burnley, for improvements in looms.

2268. Charles Thompson, and James Thompson, both of Green-bridge Foundry, Padiham, Lancashire, for improvements in apparatus for discharging condensed water, air, or other fluids, from steam pipes, drying cylinders, and other apparatus where steam is used.

2269. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for certain improvements in bakers' ovens,—being a communication.

2271. Robert Aytoun, of Edinburgh, for improvements in safety-cages or apparatus for mines.

2272. François Xavier Gentil, and Eugène Gentil, both of Paris, for improvements in preparing and treating asphodel, in order to obtain alcohol.

The above bear date August 27th.

2273. Andrew Shanks, of Robert-street, Adelphi, for certain improvements in machines for shaping and cutting metals and other substances.

2274. John Drumgoole Brady, of Calais, for improvements in saddles.

2275. William Smith, of Liverpool, for an improvement in the manufacture of size made from gelatine.

The above bear date August 28th.

2277. Robert Whittam, of Accrington, for improvements in machinery or apparatus for ruling upon metallic rollers or cylinders for printing calico and other materials.

2278. George Cumming, of Edinburgh, for improvements in apparatus for thermometric, hygrometric, and barometric purposes.

2279. John Fisher, of Carrington, Nottingham, for an improvement in the manufacture of bobbin net or twist lace.

2280. Jules Alphonse Chartier, of Paris, for certain improvements in steam-engines.

The above bear date August 29th.

2281. Joseph Gilbert, of Evesham, Worcestershire, for an improvement in combined thrashing machines.

2282. Peter Spence, of Pendleton, Lancashire, for improvements in the manufacture of sulphuric acid, and in obtaining salts of ammonia thereby.

2283. Philippe Roehrig, of Paris, for a new or improved fabric to be used for manufacturing petticoats and other parts of women's dress.

2284. William Clark, of Chancery-lane, for improvements in the application of portable rails or ways to vehicles,—being a communication.

2285. Henry Brinsmead, of Ipswich for an improvement in the beaters of thrashing machines.

2286. George Hallen Cottam, and Henry Richard Cottam, both of the St. Pancras Iron Works, for improvements in the manufacture of children's cots and metallic bedsteads.

2287. Lionel Gisborne, and Henry Charles Forde, both of Duke-street, Adelphi, for improvements in apparatus for paying out electric-telegraph cables.

The above bear date August 31st.

2289. Henry Coates, of Crawshaw Booth, near Rawtenstall, Lancashire, for improvements in heating liquids used in bleaching, dying, soaping, clearing and sizing.

2291. George Bell, of South Inch-Michael, Perthshire, N.B., for improvements in reaping and mowing machines.

2293. George William Lenox, of Billiter-square, for improvements in apparatus for sounding alarums at sea.

2297. Eugene Grenet, jun., and Alexis Vavin, of Paris, for an improved electro-magnetic machine.

The above bear date September 1st.

2299. Evan Leigh, of Manchester, for improvements in constructing certain parts of machinery or apparatus used in preparing and spinning cotton and other fibrous substances.

2301. Thomas Welcome Roys, of Southampton, Long Island, U.S.A., for improved apparatus applicable to the capture of whales and other purposes.

2303. James Petrie, of Rochdale, for improvements in apparatus for regulating the admission of air to furnaces.

The above bear date September 2nd.

2305. Thomas Holland, and John Rubery, both of Birmingham, for certain improvements in the mode of manufacturing the runners and top notches of umbrellas and parasols.

2307. Joseph Richard Atha, of Heckmondwike, William Pearson, of Birstal, and William Spurr, of Birstal, all in Yorkshire, for improvements in railway signals.

2309. Harry Inskip, of Hertford, for improvements in fire-arms.

The above bear date September 3rd.

New Patents.

Sealed under Patent Law Amendment Act, 1853.

1857.

577. Edward Mucklow.
579. W. H. Thornthwaite.
581. Samuel Draper.
585. E. and M. A. Heale.
588. C. W. Harrison.
599. Samuel Wright.
606. Thomas Rose, jun.
611. William Poupard.
612. R. A. Brooman.
613. David Patridge.
614. William Brown.
619. John Banks.
620. William Leuchars.
622. Edward Lindner.
627. William Taylor.
633. W. Hartley, and T. H. Farrar.
638. James Stephens.
645. Hugh Greaves.
650. T. J. Thompson.
652. W. E. Newton.
653. J. K. Cheetham, & T. Southworth.
655. R. A. Coward.
661. William Petrie.

666. George Hawksley.
672. R. A. Brooman.
675. Clement Sharp.
677. F. S. Hemming.
679. George Davies.
681. Samuel Faulkner.
682. Edward Cook.
683. H. R. Smith.
684. Frederick Simpson.
686. C. H. J. W. M. Liebmann.
689. A. V. Newton.
691. A. Knox, and T. Robson.
692. W. H. Barlow, and J. Samuel.
694. F. A. Fitton.
695. J. E. Duyck.
699. Charles Reynaud.
700. James Hamilton.
701. Charles Baylis.
702. R. L. Jones.
703. George Mountford.
711. J. J. Derriey.
720. E. Berger, and J. E. Matile.
721. S. L. Taylor, and T. E. Rolfe.
722. W. R. Nevins, and J. J. Yates.
727. J. Wheatman, and J. Smith.
729. Henry Bridges.
730. J. P. Oates.
731. Martin Nunn.
732. H. Bradley, and E. Wray.
734. George Marshall.
737. Henry Glaysher.
738. Henry Martin.
740. Jules Moes.
743. N. J. Amies.
747. Sir F. C. Knowles.
754. William McCulloch, and T. Kennedy.
768. Joseph Lewis.
774. M. A. C. Mellier.
775. W. G. Merrett.
778. J. F. Maire.
779. Henry Hall.
782. Charles Weiss.
783. John Parker.
785. J. P. Jourda.
786. John Chedgey.
787. G. W. Sayer.
788. J. Atkin, and M. Miller.
790. William Seaton.
791. W. Moxon, J. Clayton, and S. Fearnley.
793. W. and J. Banks.
800. M. A. Crooker.
804. B. Blackburn.
805. F. H. Head, and J. Wright.
809. William Heap.
814. John Smith.
816. J. J. Baranowski.
817. F. J. Jones.
819. R. H. Collier.
824. Samuel Fox.
832. P. Hill.
837. William Somervail.
838. R. Cassels and T. Morton.
842. J. Radcliffe, J. Fearnehough, and J. Mather.
858. E. A. Spurr.
877. W. Childs, jun.
882. J. E. D'Arcet.
902. William Smith.
907. A. V. Newton.
912. F. A. Laurecisque.
921. A. V. Newton.
931. Thomas Craddock.
934. J. H. Johnson.
938. George Spencer.
950. J. H. Johnson.
979. W. S. Gale.
994. A. V. Newton.
998. W. Oxley, and H. Strath.
999. J. A. Molineaux.
1007. William Clark.
1019. John Matthews.
1022. J. B. Robinson.
1056. J. H. Johnson.
1086. P. A. Le Comte de Fontainemoreau.
1099. H. D. Deane.
1164. Matthew Smith.
1172. W. E. Newton.
1195. W. A. Gilbee.
1210. J. H. Johnson.
1243. A. L. Cawville.
1262. Edward Davis.
1268. L. Le Chevalier Cottam.
1313. Francis Watkins.
1363. George Crawford.
1375. J. and W. Whitesmith.
1377. David Carter.
1448. B. H. Hine, and William Onion.
1452. A. de. Schuttenbach.
1479. W. E. Newton.
1480. R. J. Hendrie.
1494. James Savory.
1518. Charles Fleet.
1535. George Hornsey.
1538. L. P. L. Alexandre, and L. P. F. Mallet.
1608. J. and W. Whitesmith.
1662. C. March.
1680. James Cocker.
1699. A. V. Newton
1715. J. H. Johnson.
1720. Robert Rennie.
1822. G. A. Buchholz.
1854. Matthew Clark.
1873. F. C. Hills.
1929. Richard Hornsby, jun.

**** For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

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THE ART TREASURES' EXHIBITION.

The establishment at Manchester of the Art Treasures' Exhibition, which closed so recently after a most successful career, is an event which, though not coming directly within the scope of a journal ostensibly devoted to recording the progress of practical science, should not be passed over by us in silence, as it not only presented a valuable lesson to the lovers of art and students of mankind, but offered some points for consideration applicable to those who are engaged in scientific and mercantile pursuits.

The chief aim of the exhibition was, as is well known, to exemplify the growth of christian art on the continent of Europe, from its dawn, under the hand of the earliest masters, to its highest flights in the sixteenth century, and its subsequent decadence. It was also intended to display the planting in England of that exotic art,—its denization here, and its successful culture; and by means of this school of painting it was designed to render the public familiar with the lineaments of British worthies. The success which attended the labors of Mr. Thomas Fairbairn and his coadjutors in the prosecution of this great undertaking, can only be appreciated in full by those who have made art a life study, and are familiar with the resources of our private collections which were laid under tribute; but that their labors must have been Herculean there can be no doubt, when we see that not only was painting in oils represented in all its epochs, but also water-colors, and the subsidiary arts of line and mezzotint engraving; not to mention the rich collections of statuary, enamels, photographs, porcelain, and metal work, each of which would, in themselves, have formed an interesting exhibition. To the gentlemen of the committee, who took not merely the labor but the pecuniary risk attendant on this novel project, the nation must be greatly indebted, both for their disinterested efforts, and for the substantial good which they have achieved, as a little consideration of the matter will sufficiently prove.

In this country, it has been the custom for some years past to consider the fine arts under one of two aspects,—either as a matter to rave about—on account of the refining and enlightening properties which they are said to possess, potent alike for elevating the individual and the

nation, or as a useless but very harmless folly, in which capital to any extent might be sunk, without the possibility of affording any return for the investment. But he must be a very careless reader of history who fails to see the national importance of attaining excellence in the arts: for works of art are the exponents of the feeling of the nation and the age which gave them birth, and, moreover, they speak a language which all people can understand.

Painting and sculpture, in their earliest stage of development, proclaimed for all time the glories of the Egyptian dynasties, and while they flourished, drew homage from the surrounding nations. When, in the course of events, the power of Egypt departed, and the Assyrian empire took the lead among the nations, the same exponent was employed to shew the greatness of that people; and in those recently exhumed records, brought to light by the exertions of Mr. Layard, we find marked traces of the working of Egyptian civilization upon that warlike race. History also records, if there were no other evidence to prove the fact, that Greece also derived her first knowledge of the fine arts from the same source, and looked up to Egypt as the mistress of philosophy and science. Of the direct advantage to that country, in a mercantile sense, of an acknowledged mental superiority by a young and fiery state like Greece—which was destined to play so prominent a part in the world's history—it is difficult, at this distant period, to determine; but there is little doubt that the moral ascendancy acquired by Egypt, through its learning and refinement, preserved it from many foreign troubles to which it might otherwise have been subjected; although its wealth and enervation courted the destruction which ultimately overwhelmed it. So also, when Greece fell a prey to Roman domination, the arts which she had in the days of her glory sedulously cultivated, and still in part retained, so unmistakeably pronounced her superiority, that Rome soon became subject to her sway.

At a later era, when Europe began to emerge from the darkness of the middle ages, we find, as an invariable accompaniment of greatness in a state, the attainment of excellence in the fine arts. Thus, the finest pictures of Italy are due to the period when manufactures and commerce there reached their culminating point; at which time England was only known as a restless nation, ruled by spendthrift princes, who were ever ready to give usurious interest for borrowed money. Even the Moors were no exception to this rule; for although debarred by their religion from closely imitating natural forms, they proved themselves possessed of exquisite taste in design, both as respects the application of colour, and the elegant groupings of devices, for the ornamentation of their palaces; as the fragments of their glory, still extant in Spain, sufficiently testify.

If, then, we find the successful cultivation of the fine arts coincident with a nation's prosperity, and also perceive a decaying nation, from a lingering love and capacity for those arts, having the power to restrain the devastating sword, and draw respect and homage from a hostile people, the fine arts are not lightly to be put aside or looked upon as superfluous; but rather to be cultivated, if for no other reason, for the homage which a country excelling all others in that field of labor, cannot fail to command. It is not enough to prove ourselves the nation destined to inoculate all others with a love of freedom, industry, integrity, and all that goes to make a great people, if we can point only to our valiant deeds, which may be misinterpreted or denied; to our extended commerce, which may be contemned, as established by chicanery and intimidation; to the glories of English literature, which cannot be understood by strangers to our tongue; to the marvellous development of our manufactures, which may be held to indicate no intellectual greatness; but if, superadded to these, we are enabled to display examples of poetic power and mental refinement, in a language which none can mistake or misinterpret, and of a quality not to be equalled elsewhere, envy is at once silenced, and our detractors are disarmed. This could not, however, be, so long as we were obliged to acknowledge ourselves deficient in artistic merit; we must then be content to rank as a nation of utilitarians—a term odious to highly cultivated and sensitive natures; and therefore, however successful we might be in thrusting our goods upon our neighbours, we should utterly fail in finding a lodgement for our ideas. Now this is precisely the position we held in the opinion of Europe when Napoleon, in the bitterness of his heart, pronounced us a nation of shop-keepers. It might well have been thought so by less unscrupulous men; especially if they had had the opportunity of visiting this country; for not only were the few works of real worth produced by our artists wholly unknown abroad, but to strangers, our art treasures were inaccessible; as our National and other public galleries had then no existence. Our architectural attempts at public and private buildings, which were unfortunately patent to the world, were one and all vile, and had been so for a hundred years; although the works of our ancestors stood forth in almost every city, to shame us into better things; and moreover, elegance in our textile and other articles of manufacture was never found, nor even cared for. England at last, however, by the isolated efforts of a few earnest men in different departments of arts, awoke as from a dull stupor, and making, at first, feeble efforts to rouse herself, ultimately succeeded in shaking off her lethargy, The result of this return to consciousness of the national importance of art culture, may be seen all over the land, but the last and greatest proof of the

awakened sensibilities of the nation to the fine arts, is shewn in the success of the Manchester Exhibition, which drew delighted visitors from every corner of the three kingdoms. A step had already been taken, in connection with the Paris Exhibition, to make known to Europe the existence of British art; but it was reserved for the Manchester manufacturers to draw into one focus a perfect illustration of the growth of the English school, and to set in juxtaposition, worthy examples of the far-famed and more ancient schools of the continent.

By studying the fine gallery of ancient pictures, we are taught to set a very high value on man's inventive or imaginative faculties; for what else is there but the evidence, rather than the expression, of an elevated conception, which obtains admiration for the works of those early masters of Christian art, Cimabue and Angelo da Fiesole, whose power of drawing was little in advance of the Ninevite sculptors. Starting from these crude but valuable examples, and continuing our examination in chronological order, we trace the gradual development of manipulative skill, due to the accumulated experiences of generations of laborious artists, and the application of this newly-acquired power to the more perfect realization of their conceptions. The gilded and tapestried backgrounds are now put aside, and the spectator, in place of such disguises, is invited to look beyond the group of saints or churchmen, forming the chief feature of the picture, into distance and the open air. Crude enough, perhaps, is the landscape, but yet it is what Mr. Ruskin might call honest work: that is, it is painted as well as the artist, with his as yet untrained eyes, can paint, and it is an earnest striving after truth. As we progress, we come to the golden age of painting, when the power of manipulation or technical skill and invention, heightened by Christian feelings, are so nicely mingled in the artists' works, as to realize all that we can desire.

Passing from these marvellous creations of the Raphael era, we light upon a new phase of art, where the religious element begins to fade, and the power of the artist to falter; and ultimately we encounter examples where Christian and heathen legends are equally acceptable to the artist, and alike unsuggestive, because they take no hold upon his mind. This decadence belongs, however, rather to schools than to art generally, and thus, though we can discern but a flickering light in one place, happily we perceive a steady blaze in another. As the political power of Italy began to bow before the superior energy of the West, we find artistic power moving westward also, until it touched these shores in the reign of Charles I., in the persons of Rubens and Van Dyck. But England was then engaged in a struggle little compatible with a patient study of the arts; and the opportunity, which the presence of these men among us presented, was lost upon the nation:

their works, however, survived to teach unborn generations. In the reigns following Cromwell's usurpation, although we find evidence of a few painters, chiefly foreign, flourishing in England, yet, until the time of George III., it does not appear that the fine arts were cultivated to any great extent.

The English school may be said to date from the inauguration of the Royal Academy in 1767; at which time this country could muster but forty men, qualified by their proficiency in the arts, to take the title of Academicians. Of these, there are scarcely half-a-dozen whose names have been handed down to fame; but among those few were men in every way worthy to found a great school of painting. That the movement which they inaugurated has produced a large result, is evidenced from the fact of paintings in oil from nearly two hundred artists being included in the British department of the Manchester Exhibition (exclusive of the works in water-colors), in order fairly to represent this school, which a few years ago was not known abroad to have any existence. That it has sustained a creditable position under the severe test to which it was subjected, by being brought into close proximity with an accumulation of art treasures, illustrating all the great continental schools, is no little praise; it cannot therefore fear comparison with foreign contemporary art.

But much remains yet to be done by our artists before we can claim that supremacy which will enable England to take the same rank in painting that is awarded to her in literature and the industrial arts. The English school stands, perhaps, unrivalled in landscape, and in a certain class of interiors it has never been surpassed, even by the Dutch painters; but there are higher walks of art than these. We miss in her works that soul-sustaining power which is so evident in the thirteenth century art. With the single exception of John Martin, we know of no other English artist who has achieved anything great in historical painting, and yet we have heard much of the high aspirations of our artists in that direction, and of the niggardliness of the government in not finding them a field on which to display their strength. Indications are now, happily, not wanting among our young painters, of marked earnestness, and that combined with great technical skill, which gives promise of a high order of excellence. Whether their future will equal what is expected from them depends solely on the use they make of their creative faculty—imagination. If they allow it to slumber, it will soon depart from them, and their works will be valuable only as photographs of nature, truthfully colored; but if, by active exercise, they keep that faculty in a healthful state, it will impart vitality to their works, and give them a stamp which will make them current throughout the civilized world. Imagination, or, as it is also termed, invention, in

its highest range, is then the power in which our artists appear most deficient; but this is, in truth, the greatest power which man can possess, and that which all mankind can more or less appreciate, according to the culture of the individual, from the nursery tale to the highest flights of poetic inspiration.

The proof that we are not naturally deficient in this, the most god-like of man's powers (because creative) is, that in poetry, England has excelled all other nations, and in philosophical speculation and mechanical invention, which call into exercise another phase of the same faculty, she has proved herself in no way deficient. Our artists then, sharing at least equally the mental endowment of their countrymen, should possess among them men highly endowed naturally with imaginative power, which, combined with their unquestionable technical skill, would, if properly cultured, and then left unfettered by conventionalism, produce works of art that could not fail to impress foreign nations with a more correct notion than they now entertain of our mental refinement; and thereby smooth the way for the introduction to their favorable notice of the truths of political, economical, and moral science, in which we have far outstripped them, and which it is at once our duty and privilege to urge upon their acceptance. To some of our readers, the idea of a nation gaining in moral power through the cultivation of the fine arts, may at first appear fantastical, but let such as doubt it enquire of their own feelings—whose opinions of all their friends they most respect, and the reply will be in general, those who have acquired an intelligent appreciation of art in all its forms: and for the simple reason that, in order to gain that judgment in art, their reflective faculties were necessarily thrown into active exercise.

By means of the Manchester Art Treasures' Exhibition we have had prominently set before us the fact that, as applied to art, imagination is a vital principle, because it imparts an undying charm to works that would otherwise be simply distasteful; and that its absence cannot be compensated for by all that grace of form and harmony of color could, of themselves, effect. But if, in one branch of human labor, imagination is thus potent, why should it not be in all? Let us think less of utilitarian maxims, which, if much regarded, are apt to play the drill sergeant with our individuality, and more of the cultivation of our natural endowments; and we shall find that, although a love of art and of nature, and of poetry and music, may be stealing upon us, our senate will be as wise, our soldiers as valiant, our workshops as busy, and our ports as crowded as ever; and that the gain which we have individually experienced will be, to set a more just estimate on money than heretofore, and on the human instruments through whom we may have acquired it.

RECENT PATENTS.

To Sir James Murray, Knight, and M.D., *of Dublin, for abating the smells and increasing the fertilizing usefulness of liquid manures, sewage, gas or other liquors, and for means of raising or propelling such mixtures and other solids or fluids to convenient heights or distances.*— [Dated 14th January, 1857.]

This invention consists in the means, partly chemical and partly mechanical, of disinfecting and deodorising solid and fluid matters or substances; also of converting them into useful manures for agricultural purposes; and, lastly, of impelling solid and fluid matters, and raising them to such heights, or transmitting them to such points or places, as may be required, without the aid of pistons or such mechanism as is usually employed when steam and other gases and fluids are used as a motive power.

To effect these improvements, strong vats or condensing vessels are used, which are furnished with strong pipes or tubes, having suitable valves or cocks to admit gas, steam, or vapour, for discharging sewage, drainage, liquid manures, or gas liquors, with any solid or other deposits that may be suspended in these fluids. Some of these vessels are also fitted inside with fans or chains on axles, for agitating such liquid mixtures, and also revolving or passing through them acids and carbonates to evolve streams of fixed air, so as to carbonate the liquids, abate offensive smells, fix volatile vapours, as ammonia, and the like, and render the products better adapted for fertilizing lands and crops, and also to press on the fluids, to impel them or other bodies. Further, within these vessels is generated, or to them is admitted from separate generators, a great access of fixed air, more than saturates these liquid manures, so as to press upon their surface and force them up the pipes (when opened) to any convenient height or distance, or so as to be discharged into reservoirs, in order that, by renewed impregnation with, and compression by, fixed air, the liquid manures, and the solid particles mixed, suspended, or carried in the fluids, may, with the excess of fixed air, be discharged again either into pipes or into a higher series of cisterns, vessels, or reservoirs, so as to attain the required elevation.

The fixed air is obtained from carbonates of lime, limestones, shells, bones, coraline, or the like, or of magnesia or alkaline carbonates, bicarbonates, or subcarbonates, previously introduced into the condensers or generators in perforated cages or nets at the bottom; after which, or before it, equivalents of a mineral acid or acids, diluted or concentrated, or mixed into a dry state with light porous or suitable animal, vegetable, or mineral powders, such as charcoal, coprolite, and apatite, soot, or bone-dust, acidulous salts, or sulphurous acid, or other acid gases, mixed in water, or absorbed in carbon of peat, coal, wood, bone black, or the like, are introduced, so that when agitation is rapidly going on, the alkaline and acid ingredients may be brought into action, and the fixed air evolved.

In carrying out the invention, the patentee introduces, into perforated cases, powdered dolomite, magnesian, or other limestone, with or without coraline, apatite, coprolite, powdered bones, shells, or other animal or mineral substances containing carbonic acid, into any of the vessels already mentioned. The cases are suspended by metallic rods passing

through stuffing-boxes, at the top or end of such vessels. When muriatic acid or gas acidulates the drainage or the current of sewage, and it is closed up in the tanks, the carbonates are agitated in the liquid, thereby generating effervescence, and causing disengagement of gas; sulphuric or sulphurous acid are likewise sometimes used. The hydrochloric acid or gas, after being used to abate offensive smells in drainage, rushing into the vats or tanks, comes into repeated contact with the nets or cases of dolomite, &c., and quickly forms soluble muriates, disengaging fixed air sufficient to bicarbonate some of the remaining magnesian earth from which the muriatic acid took the lime; the fixed air also presses upon the liquids, and expels them up from the tanks or strong vats about seventeen feet of rise in the water-gauge—balancing half the common atmospheric pressure.

The condensers may be formed with an interior lining, composed of a material more or less elastic in its nature, such lining being supported by a strong outer casing. This construction of condenser is intended to admit of the internal vessel or lining being made to expand and contract alternately by the expansion and condensation of the gas or air generated or introduced therein. By this means the fluid and solid matters may be discharged from the condensers, and impelled so as to be conveyed to their required situation; and thus, whether it be required to carry forward materials intended for manures, or purified water, the reception of the material into, and its discharge from, the condensers, may be effected by the alternate dilation or expansion and contraction of the elastic lining caused by the alternating pressures of the gas or air on its inner surface, and the fluids (with matters held in suspension therein) on its outer surface; the latter being forced by the expanding of the elastic lining through pipes as required. This mode of forcing or raising fluids is also applicable to the supply of water to houses and towns, without the aid of steam-engines, especially in cases of high service, the apparatus being in each case modified to suit the particular circumstances required to be met. It is likewise applicable to the purpose of raising water to heights, for extinguishing fires, and other purposes for which the raising and forcing of water may be required.

The patentee claims, First,—"the use of acids and carbonates applied to or mixed with the contents of sewers, drains, and other channels for the passage or discharge of refuse matter, by means of apparatus and mechanism as described, for the purpose of abating smells. Secondly,—the production and consolidation of a triple phosphate of ammonia and magnesia, applicable to the purposes of manures by the combined use of such chemical substances with the apparatus and mechanism, as described. And, lastly,—the propulsion of fluid and solid matters, so as to raise or force them to convenient heights or distances, and distribute them as may be required, by means of a condensible gas or air, generated within some of the vessels or condensers, and made to press upon the surface of such matters and force them forwards; or by expanding the elastic lining of such vessels, in the manner described."

To THOMAS CHARLTON, *of Brentwood, Essex, and* WILLIAM TURNBULL, *of Rotherhithe, for improvements in steam-engines.*—[Dated 26th May, 1856.]

THIS invention consists, first, in improvements in the construction, arrangement, and mode of working the valves of steam-engines; second, in connecting the steam-valve or valves direct to the boiler or boilers, by a yielding steam-pipe or hollow piston; and, third, in working the expansion-valves, in conjunction with the cylinder-valves, of steam-engines by two excentrics, connected to one or more links.

The pressure of the steam on the valves is obviated, and the steam may be carried to the greatest limit of expansion, and conveyed to within a short distance of the termination of the stroke. Free exit for the exhaust steam to the atmosphere or condenser is secured, by allowing suitable lap on the steam-valve. The exhaust steam passes off in the usual way through the exhaust-pipe to the atmosphere or condenser, but a portion of the same passes into the steam-chest on the outside of the valves, for lubricating them; or the exhaust steam may be conveyed into the chest without an exhaust passage in the cylinder, and thence to the condenser or atmosphere.

In Plate X, fig. 1, is a section of a steam-engine, to which parts of the improvements are applied: and fig. 2, is a side view of the same. A, is the cylinder; A^1, the piston; and A^2, the piston-rod, which is jointed to the connecting-rod A^3, by a short cross-head A^4, on which the sliding blocks A^5, are mounted, and which slide in the guides A^6, to keep the piston-rod and piston moving parallel. B, is a crank, on the shaft B^1, to which the connecting-rod A^3, is attached. On the shaft B^1, the excentrics B^2, B^3, are fixed, which are embraced by the excentric straps B^4, B^5, which are firmly secured to the excentric rods B^6, B^7, the ends of which are forked and jointed to the double slotted link C, by the pins C^1, C^2. The excentrics are set on the crank-shaft B^1, to correspond to a backward or forward motion of the engine. The link is suspended by a rod C^3, jointed to it at C^4, by a pin; the other end of the rod is jointed to a bracket C^5, in a similar manner. The bracket is permanently fixed to any suitable part of the framing or foundation plate, or to any suitable part of the boiler or engine. The rod C^3, serves to keep the link in proper position, but at the same time it is capable of vibrating, while being acted on by the excentrics B^2, B^3, through their straps and connecting-rods B^4, B^5, B^6, B^7. In the slot D, a block D^1, is fitted; the sides of the link and block are flush or nearly so. D^2, is a connecting-rod, with both ends forked (in the same plane), one end of which spans the link C, and embraces the block D^1, and is jointed to it by a pin *a*, which is passed through them. The other forked end of the rod D^2, is jointed at D^3, by a pin *b*, to the valve-spindle D^4, for the purpose of giving motion to the slide-valve D^5, which has ports D^6, D^6, (one in each end), which are formed right through from front to back. These ports correspond with ports *c*, *c*, in the cylinder face, the steam ways of which lead to their respective ends of the cylinder. These ports are nearer to each other than those in the valve, to allow space for the stroke. E, is the expansion-valve, which is formed hollow, and has two ports *d*, *d*, in its face, to correspond exactly with the ports or passages D^6, D^6, of the slide-valve D^5; a space d^1, is formed between the face of the expansion and steam-valves, to allow the exhaust steam to play freely be-

tween them, and to be in communication with the exhaust steam-chest E^1, E^1, which is a space surrounding the valves completely, excepting at the parts where their faces touch. In the centre of the back of the expansion-valve E, an induction steam-port *e*, is formed which communicates with, or rather branches off to, the ports *d*, in the face of the valve. F, is a steam-pipe for admitting steam into the port *e*, in the back of the valve E. The end of this pipe is faced true, so as to bear against the back of the valve E, (which is likewise faced true) at e^1, so that when the flange e^2, abuts against the back of the valve at e^1, the parts may thus be rendered steam-tight. A recess is cut or formed in the casing, to receive the flange e^2, of the pipe F. The interior of the pipe is bevilled off at *f*, where it comes in contact with the back of the valve, so as always to have a full open port at any point of the stroke of the expansion-valve. A stuffing-box F^1, is formed in the back of the casing, through which the pipe F, projects A shoulder is formed on the pipe for the packing to press against, and is made to bear upon it by means of the gland F^2, which is formed with a flange and knife-edge or points f^2, f^2, for the bottom of the annular box F^3, to rest upon; and which is in turn pressed by the nuts *g*, *g*, on the screws g^1, g^1, causing the gland F^4, to bear against the packing in the annular box F^3. By means of the nuts the pressure may be increased or decreased at pleasure. The packing may be made of india-rubber or other suitable elastic material; or, instead of packing in the annular box F^3, a helical spring may be used for the gland F^4, to bear against. The expansion-valve E, receives motion through the spindle G, by means of the connecting-rod G^1, which is jointed to it by the pin *h*: the other end of the rod G^1, is jointed to the block G^2, by means of the pin h^1. This block is fitted in the short slot H, similar to the block D^1, and is likewise capable of being moved in it to or from either end, as desired. This is effected by means of the rods I, and J; the rod I, being jointed or attached to the pin *a*, (by which the rod D^2, is jointed to the block D^1,); the other end of this rod is jointed to a lever I^1, which is fixed, on a rocking or weigh-shaft I^2. On the same shaft another lever I^3, is fixed, at right angles to the lever I^1; this lever is connected, by means of a rod I^4, to a lever I^5, centred or pivoted at *i*. The upper end of this lever has a handle formed on it, and has a small lever i^1, jointed to it at i^2; its end is of a T-shape; a rod i^3, is jointed to this lever at i^4. The lower end of the rod is formed into a bolt passing through a shackle *j*, fixed on the lever I^5, and taking into notches j^1, in the curved plate I^6. A spring j^2, pressing on the small lever i^1, forces down the bolt *j*, into the notches j^1, thus keeping the lever I^5, the rods and levers I^4, I^3, I^2, I^1, I, pin *a*, block D^1, and end of connecting-rod D^2, in any desired position. The block G^2, is shifted in a similar manner in the short slot H, by the rod J, jointed to it by the pin h^1, by which the rod G^2, is jointed; this rod is attached to the end of the lever J^1, fixed on, or formed in a piece with, a tube J^2, through which the shaft I^2, passes. Another lever J^3, is formed or fixed on the the tube J^2, at right angles, or nearly so, to the lever J^1. A rod J^4, connects the end of the lever J^3, to another hand-lever J^5, pivoted or centred at *i*, and is similar to the lever I^5, previously described, and fixed in any desired position in a like manner. The block G^2, is shifted in the slot H, to give the necessary motion to the valve E, so as to regulate the cutting off of the steam for the required expansion. The block D^1, is shifted to either end of the slot D, so as to bring either of the connecting-rods B^6, or

B^7, into play, to move the valve D^5, to a proper position either for a forward or backward motion of the engine. The expansion may be likewise regulated by the block D^1, being placed in any position between the centre and ends of the link-slot D.

By using valves of the construction described, a considerable amount of friction is obviated on account of the steam-valvé being so formed as to allow the exhaust steam to bear a pressure all round the valves, or nearly so, and likewise because the rubbing surfaces are considerably reduced, and the area of the steam-valve-face being made much less, as there is no eduction port to cover.

Fig. 3, is a cross section of the cylinders, valves, and valve-casing of a pair of steam-engines, with modifications of the improved valves and steam-pipe applied thereto. The backs of the expansion-valves are bevilled in this modification, instead of being parallel. When placed with their faces to their respective cylinders, an angular recess *k*, *k*, is thus formed between their backs. The steam-ports are formed in the back of each valve, as shewn by the dotted lines, which ports correspond to similar ports k^1, k^1, in the steam-pipe F, the lower end of which is formed of a wedge shape to fit the angular recess, and make a steam-tight joint by bearing on the backs of the expansion-valves. The steam for both cylinders enters by the pipe F, and is distributed through the respective ports to each valve. The pipe F, projects as before through a stuffing-box F^1, F^1, on the casing; and by screwing the gland F^2, down on the elastic packing, the joint is made steam-tight. To the lower or wedge-shaped end of the steam-pipe a rod or bolt k^2, is attached, which projects through the casing, and through the piece k^4, india-rubber ring k^5, and disc k^6, and is fastened by a nut, by which the necessary degree of pressure can be put on the various valves and working faces.

Fig. 4, is a section of a modification of the steam-pipe F, and stuffing-boxes, in which the bolt k^2, is done away with. The bolts or screws *l*, *l*, for tightening the gland F^2, and the upper gland, are made of sufficient length to pass through the glands and flanges of both stuffing-boxes, and the necessary pressure required to keep the angular faces in close contact is effected by means of the stuffing-box F^1, and gland F^2. This gland is forced against the packing which abuts on the shoulder f^1, f^1, by the nuts l^1, l^1, being screwed further on the screwed rods or bolts *l*. The parts l^4, are stationary, and secured to the flanges of the stuffing-box already described by the nuts l^3, on the screwed rods or bolts *l*; and the gland of the stuffing-box of the permanent pipe l^4, is tightened by means of the nuts l^2, l^2. This stuffing-box is for the purpose of keeping the junction of the pipes l^4, and F, steam-tight.

Fig. 5, is a section of a modification of fig. 3; and fig. 6, is a section of the steam-pipe and steam-ways of fig. 5. E, E, are the valves, set as in a locomotive, with their backs facing each other. A short annular cylinder E^1, with the steam-pipe F, entering its sides at right angles, and cast in a piece with it, or otherwise, is placed between them. The ends of this cylinder face the backs of the valves. Moveable hollow pistons E^2, E^2, are inserted in the cylinder E^1, one in each end. These pistons are packed steam-tight, and have a helical spring E^3, inserted between them, so as to press both against the backs of the valves, thus rendering them steam-tight. The steam is allowed to pass from the annular space E^4, to the inside of the cylinder E^1, through the openings E^5, between the hollow pistons, and it

thence passes through them, and enters the backs of the valves E, E: in this arrangement the lap is on the inside of each steam-valve. The exhaustion of the steam takes place past the ends of the valves into the steam-chest, and thence to the condenser or atmosphere. A projection E^6, is attached to or cast on the lower side of the short cylinder or annular ring E^1, which enters a socket E^7, for the purpose of keeping it steady while the vales E, E, are in motion: in this arrangement one or more ports in the valves and cylinder faces may be used.

As a modification of the last described valves and fittings, applicable to a single engine, the steam-port is made in the side of the expansion-valve, instead of in the back. The cross section of this valve is triangular: one of the faces is applied to the back of the steam-valve as before, and the second face is horizontal, or nearly so; while the third or back of the valve is inclined, and fits into the exhaust steam-chest, which is of a corresponding shape. This valve keeps its face up to the back of the steam-valve by the pressure of a hollow piston, which is packed steam-tight in a short cylinder, that forms the termination of the steam-pipe where it joins the valve-casing.

A modification of the link motion previously mentioned, with reference to figs. 1, and 2, is next described, in which all the parts are the same, with the exception of the expansion-valve connecting-rod G^1, which is jointed to the centre of the link direct, instead of being jointed to the sliding block G^2, in the slot H, whereby the extra hand-gearing rods and levers are dispensed with.

The improved expansion-valves, fitted to a short slide-valve, may also be modified by forming two ports in the face of the slide-valve, to correspond to similar ports in the face of the cylinder. This slide-valve has a port in the back similar to the expansion-valves before explained. The expansion-valve is fitted to the back of the steam-valve, and is pressed upon by a hollow cylinder. The expansion-valve has only one port, which corresponds with the port in the back of the steam-valve: this valve is for cutting off the steam at any desired point. These valves may be worked by any of the valve gearing before mentioned, by means of the valve spindles. The slide-valve may also be fitted without the expansion-valve; the hollow cylinder in this case pressing direct on the back of the steam-valve.

Fig. 7, is a sectional view of part of a steam-pipe and short cylinder, with hollow piston, to press on the back of either valve, the pressure being regulated by the nut o, on the screwed rod o^1. This nut presses down the end of the lever o^2, which is fixed on a short shaft o^3, passing through a stuffing-box in the side of the steam-pipe F. On this shaft another short lever o^5, is fixed; to the end of this a rod is jointed, extending down the pipe and into the short cylinder, where it passes through a plate or disc o^6, until it is caught by a collar o^7, on the rod. This collar presses down the plate on to a helical spring p, which presses down the hollow piston m^2, on the back of the valve or valves. The rod, after passing through the disc, is slotted at p^1, to receive a pin, which is fixed in a stud, screwed in a boss p^2, in the centre of the hollow piston; this serves as a guide to steady the end of the rod, and at the same time to allow the piston to move up and down as far as is necessary.

Fig. 8, shews an arrangement for lifting the slotted links C, over or along the blocks in the link. The blocks in this arrangement are fixed on

the valve spindle rods without any yielding joint, and held steady by a rod working through a boss on a bracket. The slotted link is moved up or down by rods p^6, and levers p^7, similar to the mode of moving the blocks previously explained. The expansion-valve is worked from a fixed pin q, in the slotted link, to which is connected a rod q^1, which extends in the direction of the crank shaft B¹. This rod q^1, is forked, and passes through, or spans, a boss q^2, on the shaft, and which boss and fork support the rod q^1, and keep it steady. In this rod a pin q^3, is fixed, to which is attached the rod for working the valve.

Fig. 9, is an arrangement of the double slotted link C, which is shifted by rods and levers, and fixed, by means of bolts and catch-plates, similar to those previously described, when referring to the mode of shifting the slide blocks in the slots of the links, in figs. 1, and 2. In this arrangement the link is shifted on the block, to fit it for a forward or backward motion; while to set the parts to work the expansion valve, the block G^2, is shifted in the slot, and kept in any desired position by a small catch or projection formed on the handle L^5, sprung into notches L^6, formed in a segmental catch-plate L^7, attached to the reversing handle L^8, which is held by the catch-plate L^9. A rod L, jointed to the block by a pin, leads in a direction toward the crank-shaft B^1, which it spans in a similar manner to that referred to in fig. 7. On a pin L^1, near the forked end of the rod L, another rod L^2, is jointed, which works the valve by being connected to the valve spindle L^3, at L^4.

Fig. 10, is a longitudinal section of a steam-engine, with another modification of the improved valves applied thereto. M, is the steam-valve, with two steam-ports r, r, in each end through it. The cylinder has a corresponding number of ports r^1, r^1, r^1, r^1, two of which open into the steam-ways or passages to each end of the cylinder. N, is the expansion-valve, having a like number in its face, which lies on the back of the steam-valve. The rest of the parts are the same as already described, consisting of the short, hollow piston in a short cylinder, pressed down on the back of the valve N, in which the steam-port is formed. Steam is admitted through the hollow cylinders into the valve N, and thence through either end of the steam-valve M, (according to its position) and into the steam-cylinder, and propelling the piston to the end of its stroke; when the steam is liberated by the shifting of the valve, and thus allows the steam to escape through the exhaust-ports s, s, or s^1, s^1, into the exhaust steam-chest; and thence it may be taken to the condenser, or allowed to blow into the atmosphere. The valves are worked by the link motion, as described: by using two steam-ports, a very short stroke is necessary.

The patentees claim, "First,—the construction, arrangement, and mode of working the valves of steam-engines in the manner hereinbefore described. Second,—the introducing of the steam direct from the boiler to the back or sides of the valves of steam-engines. And, third,—the working of the expansion-valves, in conjunction with the cylinder-valves of steam-engines, by two excentrics, connected to one or more links."

To ROBERT TURNBULL, *of Harwich, for improvements in cradles for heaving up ships.*—[Dated 8th January, 1857.]

THIS invention of improvements in ships' cradles refers to cradles placed on inclined ways or rails for heaving or drawing up ships out of the water, and has for its object to enable the heaving up of a ship drawing more water than can be effected by the ordinary cradle on the same ways. The cradle is constructed for this purpose in parts, so that one part may separate a certain distance from the other, while, at the same time, the parts of the cradle are suitably tied and held together, to limit the separation, and to keep them in their proper relative positions while either elongated or contracted; when contracted, the cradle is considerably less in length than the ship which may be lifted on it.

In Plate IX., fig. 1, represents a side view of a cradle for heaving up ships, constructed according to this invention, with a ship partially hove up; and fig. 2, represents an end view of the same. This cradle is formed in five principal parts, A, B, C, D, and E. In fig. 1, the cradle is represented with the fore parts A and B, separated from the after parts C, D, and E; but the whole of the parts may be separated to the utmost limit, when the ship is grounded on the whole length thereof, or the several parts may be brought close together, when the ship is about to be hove up.

Fig. 3, represents a plan of the cradle, with the parts in their extended position; and fig. 4, represents a part of the detail on an enlarged scale. The general construction of the parts A, B, C, D, and E, is the same as that of cradles in ordinary use, and consists of three principal longitudinal timbers, which, in ordinary cradles, are in one piece from end to end, and unite the whole cradle together, but which, according to this invention, are made in short lengths *a*, *b*, *c*, as best seen in the plan, fig. 3. These timbers are furnished with wheels or rollers *d*, *d*, *d*, which are mounted on, and traverse, the rails or ways F, F, as usual. The longitudinal timbers *a*, *b*, and *c*, are connected by the transverse timbers *e*, *e*, on which the sliding chocks *f*, *f*, rest; the timbers *e*, *e*, are fitted and secured to the pieces *a*, *b*, *c*, in the ordinary manner, so that they may be readily taken to pieces when required; and each part of the cradle is strengthened separately by iron cross ties *g*, *g*, which may be fitted into metal sockets, so as to be readily removeable. The fore part A, is also furnished with two stays *h*, *h*; the cross timber *i*, of the after part E, is made a fixture with the side-pieces a^1, b^1, c^1, and keeps the whole of the longitudinal parts together, when releasing the cradle from under the ship.

The parts A, B, C, D, and E, are connected together by longitudinal tie-rods *k*, *k*, *k*, of iron, one of which is represented, on an enlarged scale, at fig. 4, as connected with parts of the middle longitudinal timbers *b*, *b*. These rods are fitted with iron socket pieces *l*, and l^1, the one end being fixed by cotters *n*, *n*, in the socket piece *l*; while the other end is free to slide in the socket l^1, but is furnished with a head *m*, by which it is prevented from being drawn out or beyond the position shewn in fig. 4. The socket pieces, which are fitted to the middle timber *b*, are recessed into that timber, so that the rod *k*, is entirely below the blocks *p*, *p*, on which the keel of the ship rests; the sockets being so recessed into the timbers, are secured by bolts *q*, passing through the feather or thin part of the socket. The timber *b*, is recessed throughout its length, so that the

rod *k*, may be slidden its whole length therein. The socket pieces *l*, l^1, and rods *k*, *k*, of the side timbers *a*, *c*, are similarly fitted and fixed, but so that the rods *k*, project from the sides; the rods *k*, so fitted, permit the parts of the cradle A, B, C, D, and E, to approach close to each other, or to separate to a distance from each other. *r*, is a chain attached to the after part E, and carried underneath the parts B, C, D, and connected with a short piece *s*, and secured and held thereto by a stopper, to retain the whole of the parts close together. *t*, *t*, are the pawls as used in ordinary cradles, which take into racks on the ways, to hold the cradle, after partially or entirely heaving the ship up. The several pawls of each part are connected with a rope or cord carried up to high-water mark. When the cradle is lowered down, these pawls are secured in a raised position, and so held by the cords, and are let go in succession as the several pieces A, B, C, D, and E, ascend the ways, and as it may be desired to hold the ship when fleeting the heaving purchase. When the cradle is let down the ways, for the purpose of heaving up a ship, the several parts A, B, C, D, and E, are brought close together, and secured by the chain *r*, *s*, and then lowered; the ship is then floated over it, and her fore part entered between the guide pieces *u*, *u*, and grounded on the fore part A; the chain *v*, is then hove upon, and the chain *r*, *s*, which holds the parts of the cradle together, is now let go by the pawl or stopper before mentioned, a rope being carried up to high-water mark for that purpose. By heaving on the chain *v*, or other purchase by which the ship is hove up, the fore part A, will pass up the ways with the fore part of the ship grounded upon it, leaving the remaining parts B, C, D, and E, as at first lowered; this proceeds until the parts A, and B, separate to the extent limited by the sliding bars *k*, between those parts; the further heaving up now separates the parts B, and C; the part B, proceeding up the ways, leaving the remaining parts C, D, and E, behind, until the full extent of separation limited by the sliding bars *k*, between the parts B, and C, and as represented in fig. 1; in which it will be seen that the ship is partially raised, and drawing less water forward than aft, as marked by the water line 1, 2. In this manner the heaving up is conducted, until the several parts of the cradle are entirely separated from each other, and it is extended to its full length, and to the length of the ship, in which position the vessel is about to ground on the full length of the cradle; *w*, is a guide for setting her fair on the blocks at the after end. After the separation of the several parts A, B, C, D, and E, and after the ship takes the blocks aft, the sliding chocks *f*, *f*, are brought forward by the chains attached thereto, as is well understood in lifting ships with ordinary cradles. After the ship fairly settles on the cradle, she is hove out of water on the cradle, as so extended. When raised to the point required, she is shored up at the several points between the parts A, B, C, D, and E, of the cradle, and when so properly shored and lifted from the cradle, all the cross timbers of that structure are removed, except the after piece *i*; the cross-stays *g*, *g*, are also removed. The longitudinal timbers, still connected by the sliding rods *k*, *k*, may then be traversed down the ways from under the ship, and may be again put together to heave another ship up on the same ways, if the first is carried sufficiently high above high-water mark; or the first ship may be hove in a direction transverse to the inclined ways, on "hollows and rounds," or on other suitable parts, whereby she may be so moved out of the way of the succeeding operation.

In cases where the incline of the ways is not very steep, or, from other causes, the weight of the parts of the cradle is insufficient to carry it down, an iron sheave or pulley is placed at the lower end of the ways, and a chain is passed over it, one end of which is attached to the lower end of the cradle, and the other end is carried up above high-water mark, whereby the cradle may be assisted in the descent. Before lowering the cradle, the several parts A, B, C, D, and E, are placed close together, and secured by the chain *r*, *s*, and chain-stopper, as before explained. Thus, it will be seen that, supposing the limit of the ways to be at X, say at low-water mark, the fore part of the cradle will be much nearer that point, by reason of the contraction of the cradle, than if it were of the full length of the ship to be lifted; and therefore a ship may be lifted by this means, whose stern, by reason of her draught of water, projects beyond the lower end of the ways a considerable distance. In addition to this advantage, with the improved cradle, a ship may be more readily shored up, and the cradle removed from under her after she is hove up, than is the case with ordinary cradles.

The patentee claims, "the construction of cradles, for heaving up ships in parts, whereby they may be extended or contracted, for the purposes and as hereinbefore described."

To EDWIN CLARK, *of Great George-street, Westminster, for improvements in machinery or apparatus for raising ships out of the water for the purposes of examination and repair.*—[Dated 19th January, 1857.

THIS invention consists in a method of arranging hydraulic machinery for raising ships out of the water for examination and repair. For this purpose, a series of columns are erected in two parallel rows at some suitable place where the water is sufficiently deep to float the largest ship which it is intended to raise. In connection with each of the columns is a hydraulic cylinder and ram, which, by means of descending rods, is connected with a girder or girders, extending to the corresponding post in the opposite row. Over this series of parallel girders ("termed a grid-iron"), and between the two rows of columns, the ship to be raised is floated, and the pumps in connection with the hydraulic cylinders are set to work, so as to bring each girder to bear against the keel of the ship, which is then shored in the ordinary manner; or, instead of allowing the ship to rest directly upon these girders, a strongly-framed platform is placed upon the girders, in order more perfectly to distribute the weight of the ship over the girders, and the ship then reposes and is shored up upon this platform. Afterwards the pumps are simultaneously set to work, and the girders are lifted, and are prevented from again descending by closing the water in the presses, or by pawls, which fall into suitable teeth formed at intervals on the columns. On each side of the two parallel rows of columns before mentioned, piles are driven, on which workshops are built, at or near the level to which the vessel is raised.

In Plate IX., fig. 1, is a side and end elevation, partly in section, and fig. 2, is a transverse section of machinery or apparatus for raising ships out of the water for the purposes of examination and repair. *a*, *a*, are the series of columns, erected by sinking cylinders on to the bottom, and excavating from the interior of the cylinder, which is kept clear of water

either by closing the top of the cylinder, and forcing air into it, or by pumping the water out, as may be most convenient. When one length of the cylinder is sunk, another length is bolted on to the top of it, and so on; or the columns may be fixed by forming screws on their ends, which are caused to penetrate into the earth, in the manner known as "Mitchell's patent screw pile," and which is now well understood.

Each of the columns contains a hydraulic cylinder *b*, which is supported by a strong cast-iron ring, firmly attached to the walls of the column; and the hydraulic cylinder contains a ram *d*, carrying at its upper end a cross-head *e*, from the extremities of which chains or rods *f*, *f*, descend to one end of the cast-iron girders *g*, *g*, which are strengthened by articulated bars *h*, *h*, which pass underneath the girder from end to end. *i*, is the engine house (shewn in general plan, fig. 3,) containing a steam-engine and pumps for forcing the water into the pipes which communicate with the hydraulic cylinders *b*; and in order to secure uniformity of action in lifting the girders, the presses from which they hang are arranged in three independent groups, and one of these groups contains all the presses at one end of the apparatus, whether on one or other side of it, and the two other groups contain each of them the remainder of the presses on one side of the apparatus. The presses in each group are all connected together, so that perfect uniformity of pressure is secured as regards the individual presses in each group, while the three groups themselves are so arranged that their three centres of action form a tripod support upon which the vessel may be supposed to be seated; the arrangements for working the presses being such that any point of the tripod may be raised or lowered independent of the remaining two. In this manner, a simple manipulation gives the means of insuring perfect horizontality during the act of raising or lowering the gridiron with the vessel upon it.

When a ship is to be lifted, it is floated over the girders *g*, *g*, or over a platform placed upon these girders, and water is then forced into all the hydraulic cylinders *b*, *b*, until all the girders, or the platform placed upon them, are brought to bear on the keel of the ship, and then, when the ship is shored, the lifting operation commences. When the examination or repair has been effected, the ship is lowered by allowing the water to escape gradually from under the rams. When a large number of ships have to be raised by one raising machine, then the ships are not repaired on the raising machine, but previously to floating the ship, a large shallow iron vessel, called a "saucer," is sunk on to the girders, and the ship and saucer are raised together. The saucer thus forms the platform before alluded to. As the saucer rises above the water, it empties itself by a valve in its bottom, and when the girders *g*, are again lowered, the saucer floats away with the ship inside it.

In case greater lifting power is required than is given by these presses, the saucer is decked over, or air vessels are constructed of sufficient dimensions within it, so that by pumping the water out of such air vessels, or out of the whole area of the pontoon while it is sunk, the lifting power may be increased to any required extent; the horizontal position of the saucer being always maintained by the presses, which consequently must always lift a portion of the weight.

The patentee claims, "the general arrangement of the apparatus herein described, and particularly the erecting the parallel rows of columns between which the girders are suspended, by adopting the system used in

bridge constructions, of sinking wrought or cast-iron cylinders, or cylinders with screws, and excavating from the interior of them. Also, the dividing the hydraulic cylinders into separate sets, each set being in connection, by suitable main pipes, with its own pump or pumps, so that each set may act independently of the other sets, in place of connecting all the cylinders to one pump and to one main pipe, as has before been proposed to be done. Also, the combined machinery or apparatus, consisting of a set of girders raised by hydraulic apparatus, as already described, and a large shallow iron vessel, called a saucer, for raising ships out of the water for the purposes of examination and repair."

To EDWIN CLARK, *of Great George-street, Westminster, for improvements in floating docks.*—[Dated 19th January, 1857.]

THIS invention consists in arranging a floating dock, so that it may be sunk in order to receive the ship, and after having received the ship be floated by pumping the water from the space between the side of the ship and the dock. By allowing the dock thus to rest on the bottom, the air-vessels heretofore used to keep the dock floating while receiving the ship are dispensed with.

In Plate IX., fig. 4, is a transverse section of a floating dock, constructed according to this invention. *a, a,* is the iron skin or shell of the dock, bolted to the transverse girders *b, b.* These girders are built up of plates of iron, bolted to angle irons b^1, b^1, at the top and bottom, so as to form flanges, and connected together sideways by covering pieces of T-iron b^2, b^2: in this way sufficient strength is obtained to support the weight of a ship, the keel bearing at the centre of each of the girders. At the ends, the girders are turned up, so as to form the sides of the dock, and are strengthened at the back by wooden beams b^3, b^3. *c, c, c,* are three longitudinal girders or ribs, which run from end to end of the dock; they are constructed in a similar manner to the transverse girders *b,* which they connect together. One end of the dock is closed by gates of the ordinary description. When a ship is to be docked, the floating dock is sunk on a prepared bottom, and it then rests on the wooden blocks *e, e*; the gates are now opened, and the ship is floated in; the depth of water in which the dock is sunk being such as to admit of this, but not being sufficient completely to submerge the dock. After the ship has entered, the gates are closed, and the water is pumped out of the dock until the vessel begins to bear on the girders *b*; it is supported by the shores *f, f,* which are stepped on to the ledges *g, g,* running from end to end of the dock, and bolted to the girders *b, b.* When the ship is securely shored, the dock is pumped dry, and it then floats with the ship in it. This floating dock is adapted to be used in places where there is no tide, or where the rise and fall of the tide is very small; but if, at the position where the floating dock is to be used, the rise and fall of the tide is considerable, then the height of the sides of the dock may be much reduced, as they need only be high enough to remain uncovered at low water for a sufficient time to allow of the water being pumped out of the dock. When the tide rises and falls to such an extent as to leave the bottom on which the dock is sunk dry at low water, then the height of the sides of the dock is reduced, and forms what the patentee terms a "saucer." Fig. 5, is a

portion of a longitudinal section of this vessel, and fig. 6, is a sectional end view. *a, a,* is the external skin, made of sheet-iron plates rivetted together ; *b, b,* are transverse girders, which in this instance are built up of wood bolted together, and arranged in such a manner, that a weight put on the girders *b*, has a tendency to keep the skin *a*, extended ; b^1, b^1, are baulks of timber forming the upper part of the girders *b*, and on the centre of each of which the keel of the vessel rests ; *c, c,* are longitudinal girders or ribs running from end to end of the saucer ; they consist of iron plates, rivetted together, and to flanges of L-iron at the top and bottom. These flanges at the bottom are rivetted to the skin *a*, and at the top they are bolted to the baulks b^1. *d, d,* is the planking or flooring, which is supported by the longitudinal joists d^1, d^1, resting on the bottom or skin of the saucer. When a ship is to be placed on the saucer, the latter is sunk either in a tideway, as before mentioned, or in an ordinary graving dock, or on to a raising apparatus, described in the preceding Specification, and the ship to be raised is floated over the saucer and shored in a similar manner to that used for shoring ships on Morton's slip ; then, as the tide falls, or the water is pumped out of the graving dock, or as the saucer is raised, the water runs out of the saucer through an orifice which is furnished with a flap-valve, arranged so as to let water run out and prevent its running in. On the return of the tide, or when the water is re-admitted to the dock (if a graving dock has been used), or when the saucer is again lowered (if a raising apparatus has been used), the saucer will float with the ship, and may be removed to a place suitable for effecting the required repairs.

The patentee says, "I claim the constructing floating docks, by which I mean vessels arranged suitably for receiving ships into or on to them, and of floating with such ships in or on them, without air vessels to keep them floating when filled with water. I also claim the constructing floating docks with transverse girders or frames, connected together by longitudinal ribs, as herein described. I also claim the constructing floating docks with sides less in height than the draught of the largest ships which they are constructed to dock. I also claim the constructing floating docks without gates."

To John Brown, *of Liverpool, for improvements in the construction of ships' yards.*—[Dated 18th December, 1856.]

In consequence of the difficulty of obtaining spars of suitable length and strength for the lower and topsail yards of ships, especially ships of large class, and the tendency of wooden spars to decay at the ends thereof, and in the sheave holes ; and further, as iron is of too rigid a nature to be used entirely as a substitute for wood, the patentee proposes to remedy these objections by combining wood and metal together in the construction of ships' yards, in the following manner.

The figure in Plate X., is a sectional elevation of one end of a ship's yard, formed of a combination of wood and metal, constructed according to this invention ; A, is a wooden spar, of about three-quarters of the length which the yard is required to be, and the other fourth part is formed of two wrought-iron tubes B, respectively fixed on each end of the spar for about two feet ; the ends of the spar abutting against the cross

pieces of metal *b*, fixed inside such tubes. These tubes are closed at their outer extremities, as at *b**, and the necessary tackle may be connected to the yard by rings and pulleys, or in any convenient manner. The metal of which the tubes are made is continued from the circular part of the tubes, in four taper arms or strips C, of equal size, extending about six feet along the wooden spar, and terminating in points. These strips of metal are employed for securely fixing the tubes B, to the spar, by means of wrought-iron hoops D, of suitable number and strength; which, when driven tightly over the strips, firmly connect the metal to the wood. By thus constructing ships' yards, in the event of the wooden portion of the yard becoming broken, the metal tubes may be easily and readily removed therefrom, and attached to another wooden spar, thereby utilizing the metal portions of the broken yard.

The patentee claims, "the combining of wood and metal together in the construction of ships' yards, as above stated."

To JOHN CHANTER, *of Bow-road, and* JOHN WAKEFIELD, *of Suchicore, Dublin County, for improvements in the fire-boxes or furnaces of locomotive engine boilers.*—[Dated 10th January, 1857.]

THIS invention has for its object improvements in the fire-boxes or furnaces of locomotive engine boilers, so as to permit of coal being burned therein without the generation of smoke. The water spaces at the sides, back, and front, are made with tubular openings through them, to admit air to the fire on the fire-bars, and also above the fuel on the fire-bars, so as to pass into the fire-box, to mix with the products rising from the fire. In order to maintain a draught through the flues when the locomotive engine is standing still, a steam-pipe with a cock is used, to admit steam from the boiler to the chimney; and to keep the bottom of the fire free from clinkers and ashes, reciprocating or moving bars are used, which, when desired, are put in motion by the engine-man or stoker, by means of handles. These handles, by connecting-rods, give motion to a rocking-shaft, which, through other rods, give motion to a second rocking-shaft, which gives motion to the reciprocating or moving bars; and in order that the fire may be discharged, the furnace or fire-bars are so arranged that they may be made to drop at one end, and be again raised and held in position for use.

The figure in Plate X., shews a part of a longitudinal section of a fire-box of a locomotive engine, constructed and arranged with apparatus according to this invention. *a**, *a**, are air-passages through the water-spaces at the sides, back, and front of the fire-box of a locomotive engine boiler. These passages are formed of tubes, which are fixed at their ends to the outer and inner plates of which the fire-box is constructed; hence such tubes act as stays, and give strength to these parts. By thus applying air through such constructions of fire-boxes on all sides, and above as well as below the burning fuel in the fire-box, coals may be more freely burned in locomotive engine fire-boxes. In order to insure the burning of the fire when a locomotive engine is at rest, a pipe, having a valve therein, is applied in addition to the ordinary apparatus for getting a draft through the chimney by jets of steam, by which means steam from the boiler may be admitted to the chimney during the time that the locomotive engine is

at rest; at other times the cock or valve may be kept closed. In applying reciprocating fire-bars to locomotive engine fire-boxes, it is necessary so to arrange and work the apparatus connected with reciprocating fire-bars, that they may be able to discharge the fire therefrom. *a, a*, are the moveable fire-bars, having alternate stationary bars. The moveable bars have projections a^1, a^1, at their under sides, between which the raised pin or projection on a rocking-shaft *c*, enters. On the shaft *c*, is a crank *d*, which, by means of a rod *e*, is connected to the lever handle *f*; here the engine-man or stoker can at any time communicate a reciprocating motion to the bars *a, a*, and thus clean the lower part of the fire, by breaking up the clinkers formed on the bars. The frame *g, g*, which carries the fire-bars *a*, and *b*, is arranged in a suitable manner to admit of the bars being caused to assume an inclined position. g^1, g^1, are arms of the frame *g*, which, at their outer ends, are attached by rods *h, h*, to arms *i, i*, on the axis *j*, as shewn; *k*, is a screw shaft, passing through a screw nut *l*, which moves freely on axes carried by the forked arm *n*, on the axis *j*. The screw shaft *k*, turns freely in, and is supported by, the fixed bearing *m*, and motion is given thereto by the cranked handle n^1.

The patentees claim, "the combined apparatus for applying reciprocating fire-bars to the fire-boxes of locomotive engines."

To James Owen, *of Worsley, Lancashire, for certain improvements in machinery or apparatus for the prevention of accidents in ascending and descending shafts of mines, which said improvements are also applicable to hoisting and other lifting machines.*—[Dated 30th January, 1857.]

This invention relates to a novel description of apparatus for arresting or stopping the descent of the "cage" employed in mines and other shafts, if the winding rope, band, or chain, by which it is suspended, should break or be dissevered; and also to the novel formation and action of the bars or rods employed to retain the waggon, bucket, &c., in the cage.

The figure in Plate X., is a front elevation of the cage, having the improvements applied thereto, shewing the position of the levers and connecting-rods as when suspended; the dotted lines indicating the position of the same parts when holding or "gripping" the guide-rods on the disconnection of the rope. This figure also shews the connection and action of the bars or rods employed to retain the waggon within the cage. *a, a*, is the cage, and *b, b*, the levers, which grip the rods *c, c*; these rods extend from the top to the bottom of the shaft, and also act as guides for the cage during its ascent and descent. *d, d*, are connecting-rods, which are united above the cage by the tie rods *e, e*, and form the connection between the suspending rope and the levers *b, b*, supporting the cage. *f, f*, are springs, by which the more efficient action of such levers is ensured, by means of the formation and arrangement of the bars *g, g*, and their connecting-rods *h, h*. It will be evident that both ends of the cage may be opened or close at the same time, and from either side of the shaft.

The action of the various parts of the apparatus will be more easily understood by the following detailed description thereof:—When the rope or suspending medium is perfect and entire, the levers *b, b*, will be kept free from contact with the guide-rods *c, c*, assuming the position as drawn

in black lines, and allowing of the uninterrupted ascent or descent of the cage in the shaft; but, in the event of the rope becoming dissevered, disconnected, or rendered otherwise incapable of retaining the cage in suspension, the weight of the cage is then thrown upon the fulcra of the levers, the longer ends thereof being allowed to fall, and, in consequence of the disconnection from the rope, will cause the shorter ends to rise; and pressing inwards, or gripping the guide rods, will effect the instant stoppage of the descent of the cage; the levers and rods then being in the position shewn in dotted lines in the figure.

The patentee claims, "the novel description, construction, and arrangement of mechanism or apparatus to be employed for the prevention of accident in ascending or descending the shafts of mines, hoists, &c., as hereinbefore described."

To GEORGE WRIGHT, *of Sheffield, for improvements in stove grates or fireplaces.*—[Dated 6th February, 1857.]

THIS invention relates to a novel description of fire-place, combining certain arrangements for the escape of the smoke and gaseous products of the fuel into the flue or chimney, together with the means of obtaining a more perfect control over the draught; also in so constructing certain parts of the same, as to obtain a large radiating surface, and, at the same time, conceal the ashes and other solid products of combustion.

The improvements consist in making (in addition to the ordinary valve or door at the back of the grate for the escape of the smoke) a portion of the radiating top-plate itself moveable, so as to give a large opening, when required, for any increased volume of smoke that may be produced at first lighting the fire, or at any other time afterwards; and to allow such smoke or gases to ascend the flue or chimney without obstruction. The valve or door of the flue also is so hung as to enable it to be adjusted to any angle that may be desired, so as to afford a greater or less aperture for the ascending smoke. The next improvement consists in the arrangement of a cast-iron plate or plates placed upon the hearth, so as to give increased radiating surface, and at the same time to conceal from view the ashes that fall from the fire.

In Plate X., fig. 1, is a transverse vertical section of a stove, constructed according to this invention; fig. 2, is a sectional plan view, part of the front and top plate being represented broken away, in order to shew the hearth-plate beneath; and fig. 3, is an enlarged view, shewing the mode of opening and closing the valve-door *f*. *a*, is the front plate of the grate; *b*, the large or outer radiating top or back plate; *c*, the inner or moveable top or back plate, which is mounted and turns upon the axle *d*, by which means it may be opened or thrown back, to afford a large opening for the escape of the smoke, as represented by the dotted lines in fig. 1, where, however, the top or back plate *c*, is shewn by the dotted lines as being only partly open; *f*, is the valve or smoke door, and *g*, a piece of iron, affixed to and projecting from the back of the valve *f*, and taking a bearing upon the plate *h*, behind; by which means the valve *f* is supported in its place, and retained in any required position. The under side of the projecting piece of metal *g*, is made in the form of an arc, having a shorter radius than the distance from any point in the arc to the

axis upon which the valve door turns. The valve door *f*, is perfectly loose, and free to slide up or down the short incline formed upon the axle *d*, of the moveable top plate *c*. This arrangement forms a self-adjusting leverage, whereby the weight of the valve *f*, is made to act as a counterbalance to its tendency to fall backwards or forwards, as it is declined from a perpendicular position; and combined with an ordinary amount of friction of the door upon its bearings (which renders a very accurate adjustment of the counteracting forces unnecessary), enables the valve *f*, to be placed at or moved to any given point where it will remain stationary. The radiator-plate is seen at *j*, and by having its rays made of a waved or curved form and placed diagonally, as shewn at *k*, fig. 2, gives an increased radiating surface, and at the same time hides the ashes from view.

The patentee claims "forming a large opening for the escape of smoke and gases, by throwing back the whole or part of the radiating top plate, by moving it upon a bearing or axle connected with its lower edge, and thus causing it to form a part of the flue, and guide the smoke and gases in their escape up the chimney, without presenting any obstruction to the draught. Second, the mode of suspending the valve-door, so as to enable it to be set at any given angle. And, third, the mode of constructing the radiator, whereby an increased radiating surface is obtained, and the ashes are concealed from view."

To WILLIAM HENRY THORNTHWAITE, *of Newgate-street, for certain improvements in barometers.*—[Dated 27th February, 1857.]

THIS invention consists, Firstly,—in making barometer tubes, or that portion thereof employed for observation, with a flattened bore, instead of the ordinary circular one; for the purpose of facilitating the reading. Secondly,—in employing a coating or covering of enamel on one side of the glass tubes of barometers; or the enamel may be incorporated or inserted in the substance of the glass during its manufacture. Thirdly,—in graduating or marking divisions upon flattened glass tubes of barometers in lieu of, or in addition to, the ordinary graduations which are upon the stand, to which the glass tube of the barometer is affixed.

The patentee claims, "First,—making barometer tubes with a flattened bore. And, secondly,—combining enamel with the glass in the manufacture of the glass tubes of barometers, as above stated."

To CHARLES PAUVERT, *of Chatellerault, France, for certain improvements in manufacturing iron.*—[Dated 2nd March, 1857.]

THE object of this invention is to deprive or drive off from puddled iron sulphur, phosphorus, and other metalloids, by cementation: it is applicable to puddled iron in any of its stages or states. For this purpose, the patentee employs a cement, composed of the following substances:—14 parts (by weight) of oxide of iron; 30 ditto, highly aluminous clay; 50 ditto, carbonate of lime or wood ashes; 4 ditto, finely divided charcoal; 1 ditto, carbonate of potassa; 1 ditto, carbonate of soda. These proportions need not be rigorously adhered to, but may be varied, and one or more of the substances composing the cement may be dispensed with, according to circumstances and the nature of the iron.

The iron is placed with the cement, in layers, in a cementing furnace, and heated in the ordinary manner. This iron, after cementation, is welded, and then drawn into bars; it then becomes as soft and as tenacious as iron made with charcoal. The many electric currents produced by the mutual reaction of the elements, the reduction of the earthy and alkaline metals and of a portion of the oxide of aluminium, favor the escape and the absorption of phosphorus, sulphur, and other metalloids. In order that all the carbon may be decomposed, and disappear in the state of oxide or carbonic acid, it is necessary that the carbonates and oxides should be in excess.

The patentee claims, "the manufacture of iron by the means and in manner hereinbefore described."

To Charles Pauvert, *of Chatellerault, France, for certain improvements in manufacturing cast steel.*—[Dated 2nd March, 1857.]

The object of this invention is to decarbonize cast iron by prepared oxide of iron, and to free it from gaseous and solid metalloids.

The inventor crushes cast iron, heated to a red heat, under rolls, or under a tilt hammer or broad-faced forge hammer. The portion of the cast iron reduced to a fine powder serves for the preparation of the oxide, while that which is in coarser particles serves for reguluses or metal. To render the oxidation complete, the powdered cast iron is wetted with pure, acidulated, or alkalized water.

To obtain cast steel recourse is had to the processes and apparatus now used for fusing. In a melting-pot is placed from 33 to 40 parts (by weight) of oxide, prepared as just stated, to 100 parts (by weight) of crushed cast iron; and to every hundred parts of cast iron, 8 or 10 parts of the following composition are added (which must be kept as free as may be from exposure to the air):—4 parts (by weight) of dry carbonate of soda, 4 ditto of dry carbonate of potash, 3 ditto of wood ashes, 2 ditto of borax, 3 ditto of oxide of manganese, 4 to 7 ditto of hydrogenated carbon, soot, or lamp black. These ingredients should be carefully mixed, but the number and proportions may be varied according to the product desired.

Instead of oxidized cast iron, iron filings or iron raspings may be used, the same being oxidized by the same process; and, instead of 4 parts of dry carbonate of potash, 2 parts of caustic potash may be employed.

The numerous reactions of these ingredients produce the following effects:—1. The generation of numerous electric currents; 2. Complete reduction of the manganese and oxide of iron (produced by the oxidised cast iron or iron filings), which unite with the steel; 3. Reduction of the earthy and alkaline metals and borax, which absorb the metalloids; 4. Disappearance of the nitrous gases, because potassium, sodium, and calcium, reduced in presence of steel and of carbon in an incipient state, absorb nitrogen, and form cyanides of potassium, sodium, and calcium; 5. Formation of larger crystals in the steel, when it cools down, than have hitherto been produced in steel.

The patentee claims, "the manufacture of cast steel by the means and in manner hereinbefore described."

To Charles Pauvert, *of Chatellerault, France, for certain improvements in manufacturing steel and cast steel.*—[Dated 2nd March, 1857.]

The object of this invention is, first, to purify iron, and to combine it chemically with carbon by cementation; and, secondly, to convert it into cast steel of superior quality, whatever the nature of the iron first employed.

The patentee first provides a cement, composed of the materials and in or about the proportions following:—33 parts (by weight) of finely divided charcoal; 33 parts (by weight) of highly aluminous clay; 33 parts (by weight) carbonate of lime or wood ashes, one part (by weight) carbonate of soda; one part (by weight) carbonate of potash. The iron to be operated upon he stratifies with this cement in an ordinary cementing furnace, and heats it in the same manner as is now generally followed. Steel is thus obtained, possessing all the qualities of that known as German or "Rives," or shear steel (*"acier d'Allemagne ou de Rives"*). The successive heats and firings do not cause it to part with the carbon, which is intimately combined with it as in cast or in shear steel. And for this reason, carbon, having but a small affinity for iron, requires, in order to enter into intimate combination with it, first, to be added in an incipient state; second, to be assisted in its combination by numerous electric currents.

Now these conditions are fulfilled by the improved process; for, first, the mutual reaction of the carbon and the carbonates causes the greater part of the carbon to assume a molecular state; second, this change of the carbon and of the carbonates, and the action of the red-hot iron upon the oxides of aluminium, of calcium, of potassium, of sodium, with the carbon in the molecular state, produce or generate numerous sources or currents of electricity. Further, the earthy and alkaline metals, appearing in an incipient state, greedily absorb sulphur, phosphorus, and the other metalloids. Thus prepared, this steel may be used as shear steel or German steel (*"acier d'Allemagne,"*), the properties of which it possesses.

For converting this steel into cast steel, the ordinary processes of fusing in pots are followed, but with the addition to the metal in the pots of from five to six per cent. (by weight) of the following mixture, which, as far as possible, must be kept from contact with the atmosphere:—four parts (by weight) dry carbonate of soda; four parts dry carbonate of potash; three parts wood ashes; two parts borax; three parts oxide of manganese; four to seven parts hydrogenated charcoal, soot, lamp-black, &c. The four parts of carbonate of potash may have substituted for them two parts of caustic potash. The mixture of these substances should be effected with care, and their number and proportions may be varied to suit the nature of the products to be obtained. The reactions of these substances produce the following effects:—First, the generation of numerous electric currents; second, complete reduction of the manganese which unites with the steel; third, reduction of the earthy and alkaline metals, and of the borax which absorb the metalloids; fourth, disengagement and disappearance of the azoted gases,—because potassium, sodium, and calcium reduced in presence of the steel, and of the carbon in its incipient state, absorb azote to form cyanides of potassium, of sodium, and of calcium; fifth, formation in steel of crystals of larger or of greater volume than by the ordinary processes of manufacture.

The patentee claims "First, the manufacture of steel by the means and in manner hereinbefore described. And, second, the manufacture of cast steel by the means and in manner hereinbefore described."

To CHRISTOPHER BINKS, *of London, for improvements in treating ore in the manufacture of iron, and in obtaining products therefrom.*—[Dated 3rd January, 1857.]

THE objects of this invention are to effect, among the materials present, in and through the operations of the blast furnace (when those operations are applied to the reduction of iron ores), the production of certain cyanogen compounds simultaneously or conjointly with the reduction of the ore, and the purification of the metal, and of the fuel; in other words, to effect the removal from the metal of certain impurities that may be, or that are commonly contained in the ore itself, or to prevent certain impurities that may be contained in the fuel, or that are peculiar to some kinds of fuel, from being taken up by the metal in the process of reduction, and so to conduct those reducing and purifying operations, that there shall be obtained concurrently, and as special products of the operations of the furnaces, certain cyanogen compounds, to be applied to other industrial purposes.

The invention consists in the employment, in the manner and in the relative proportions as hereinafter specified, of alkaline matter, in addition, in some instances, but in others in place of, lime, or of silica, or of other fluxing materials that are commonly used, to aid the reduction of the ore, and the purification of the metal.

The kinds of iron ore with which it is preferred to operate, are those that are the freest from alumina and from silica, such as good hematite, magnetic and specular iron ore, and other peroxides of iron, spathose iron ore, or carbonate of iron, black band, &c. When operating upon tolerably pure or rich ores, the usual addition of lime, as the fluxing agent, may be dispensed with, and the alkaline matter only employed as the flux. But these processes can with advantage be carried on, by superadding the alkaline matter to the materials ordinarily used in the blast-furnace operations, namely, to the ore, the limestone, and fuel, or to mixtures of different kinds of ores and the fuel.

The kind of alkaline matter preferred is soda, in form preferably of carbonate of soda; but potash, or the potash-carbonate may also be employed. The quantity of carbonate of soda used is relatively to the quantity of fuel, in proportions varying from two to ten per cent. of the fuel, such proportions varying according to the kind of fuel, and to the greater or less purity both of it and of the ore; the intention in respect of proportions being that there shall be present as much alkaline base as, on the one hand, shall not interfere with the free combustion of the fuel, or the heat and activity of the furnace, and, on the other, shall be sufficient fully to combine with the impurities of the ore, or of the fuel, or of both, and form readily fusible compounds. It is desirable so to apportion the quantity of alkali, as to make the operations of the furnaces yield as large a proportion of cyanogen products as possible: first, because the larger the proportion of this re-agent present, and in contact with the ore or the reduced metal during the operations, the more complete is the final purification of

the metal; and, secondly, because of the value of the mixed cyanogen product these operations result in producing; the larger such produce is, the more profitable is the entire working of the furnace. The alkali is mixed direct with the fuel, and the furnace is charged with alternate batches of the broken or the roasted ore and this alkalized fuel. When charcoal or raw coal is the fuel used, the dry alkali may be mixed with it, or the charcoal or coal be impregnated with, or have thrown upon it, a solution of the alkali. When coke is used, it may be treated in the same manner; or the original coal, before being coked, may be mixed with the dry alkali, or be impregnated with, or have thrown upon it, a solution of the alkali, and so on. But for most practical purposes, the throwing in of the dry alkali along with the ore and the fuel (after the manner now practised, when, for example, lime is the flux used), will be found both convenient and effective.

The operations of a blast furnace so charged, and which, in other respects, is worked in the usual manner, result in the abstraction from the metal (through the formation of compounds with the alkaline matter) of the sulphur, the phosphorus, the silicon, or the silica, and of some other impurities in the ore, and of like impurities from the fuel, in the complete or better reduction to the metallic state of the iron oxides present; together with the concurrent formation of an alkaline cyanide, holding, combined or mixed with it, the impurities of the fuel and of the ore. This alkaline compound, or mixture of compounds, so produced, accumulates in the well of the furnace, along with, or floating upon the surface of, the molten metal, and in their fluid or semi-fluid state may from time to time be run off, or be otherwise removed from the furnace. This alkaline product consists, finally and generally, of a mixture, in varying proportions, of some still unreduced carbonate of soda (when a soda compound is the alkaline matter used), some silicate of soda, some carburet, cyanide, and sulphocyanide of sodium, along with phosphorus, &c., and the whole is valuable (for example) in its application as manures, or as a crude cyanized material, out of which to manufacture other and well-known compounds of cyanogen.

The patentee claims, " the addition, in the manner and in the relative proportions above specified, of alkaline matters along with ordinary fluxing materials; and the substitution of alkaline matters in place of lime and other ordinary fluxing agents, for the special and concurrent purposes of reducing the ore and of purifying the metal, and of producing simultaneously valuable cyanogen and other compounds, in the manner as hereinbefore described."

To Christopher Binks, *of London, for improvements in obtaining certain compounds of cyanogen.*—[Dated 3rd January, 1857.]

The primary object of this invention is to effect the conversion of an alkali or an alkaline carbonate or carburet, into a cyanide or cyanuret suitable for being used for various industrial purposes, or for the preparation of other compounds.

The invention, in the first place, consists in placing the alkaline matter, or the materials for yielding the alkaline matter, along with the proportion of associated carbon, namely, charcoal or other carbonaceous matters or materials capable of yielding carbon, and the fuel needed to give the requisite temperature to the mixture, in cupola, blast, or other furnace, in

which a high temperature, under the action of a blast of atmospheric air, is applied to effect the reduction of the alkali, and, through the combination with the nitrogen of the air and some of the excess of carbon present, its transformation into a cyanide.

The kind of alkali preferred to be used, is a solution of common carbonate of soda, and in this, charcoal is saturated. This (so called) alkalized charcoal is then mixed with the proportion of fuel (which may consist of charcoal, or of common coal, or other carbonaceous matter) needed to maintain the whole at a full red or white heat on application to the furnace of the blast. In place of the carbonate of soda as the alkaline element, carbonate of potash, or any elements yielding an alkali and alkaline carbonate or carburet, may be used, and these kinds of elements are well known.

When the final products are to be applied to purposes wherein sulphur or phosphorus would be injurious, as in the purification of iron, or the conversion of iron into steel, then the alkali or alkaline-yielding materials must be selected from such as are free from sulphur or phosphorus compounds (as, for example, the carbonate of soda should be free from all sulphate of soda, and so on); but when the final products are to be applied (for example) as manures, then the selection of such pure alkaline matter is not needed, but, on the contrary, the presence of such elements as sulphur and phosphorus is of advantage. In place of impregnating the carbonaceous matter with the alkaline solution, the alkaline matter may be mixed with it dry, either by grinding the two together or by roughly mixing them together. The relative proportions of alkaline and of carbonaceous matters should be from about 5 to 20 of the former to 100 of the latter.

The furnace is first charged with ordinary fuel, the blast applied, and the whole fully ignited and heated before addition of the alkalized carbon, or of the alkali and its proportion of carbonaceous matter. The furnace is conveniently formed, charged, and worked in a similar manner to that of an ordinary iron-making blast furnace, and is furnished with a well below the tuyere holes, for the reception of the fused cyanide as it is formed, and as it falls or runs down through the other materials to the bottom. From this well or receptacle the cyanide is run off, or is otherwise removed from time to time as it accumulates.

This invention, in the second place, consists in the application of one or other of the following kinds of furnaces or apparatus, in which to effect the same objects in the formation of alkaline cyanides. The same kinds of materials hereinbefore mentioned are placed in furnaces or kilns, or ovens, constructed and worked similarly to ordinary coke ovens, as regards the admission of atmospheric air, for the support of the combustion of so much of the carbonaceous matter present as is equivalent to maintain the degree of heat required, and to furnish the nitrogen for the formation of the cyanogen, but not to consume the entire quantity of carbon, or materially to affect the desired or cyanogen product chymically after its formation. Or the same kinds of materials may be placed and worked in kilns, constructed and arranged similar to lime kilns, and in which, alternately with the materials to be chymically altered, are placed layers of fuel; and the air is admitted in quantity chymically sufficient to keep up the requisite temperature, and by its nitrogen to form cyanogen—and thence the cyanide—but not to affect the final chymical condition of

the product. To the furnaces employed for these purposes may be appended wells or sunken receptacles, for receiving the product as it is formed and falls through or runs down, and which wells or receptacles are best situated below the orifices or tuyeres, or other inlets through which the air finds its way, or is forced into the furnaces. These sunken parts or wells being intended to keep the final product before its removal from the furnace out of reach of contact with the oxygenized air as it enters, and consequently to preserve the product—that is, the cyanide—from injurious chymical action that might follow upon such contact. Or the same results are obtained from the same kinds of materials by piling them up in beds or heaps on the ground, and without the aid of furnaces or kilns or ovens, as before. The alkalized charcoal or carbonaceous mixture is placed in layers alternately with the fuel, and surrounded with fuel, so arranged as to admit sufficient air to maintain a slow combustion of the fuel, and give to the materials the requisite heat and nitrogen to form the cyanide. The outsides of these heaps may be covered with some non-combustible, or with a layer of coal or other fuel damped so as, when the fuel at the bottom is ignited, to cause the products of the combustion—namely, the deoxidized air, or nitrogen, &c.—to permeate throughout the entire mass. In like manner as before, the ground upon which these heaps stand may be hollowed out, in order to receive and protect the cyanide after its formation.

This invention consists, thirdly, in combining with the alkali and the carbon, coprolites or bones, or other phosphates of lime, and in exposing such mixture to a high temperature, and the conjoint action of nitrogen derived from, or in form of, deoxodized atmospheric air, and an excess of carbon, in the manner just described, as being applicable when a cyanide is to be produced. Under this kind of treatment, the phosphate is decomposed, and, simultaneously with the production of the alkaline cyanide, there is obtained a combination or mixture of that with phosphorus, or an alkaline compound or mixture of phosphorus, carbon, and nitrogen, well suited for many useful purposes, but more especially for manures.

The patentee claims, "First,—the application of a blast of atmospheric air to alkalized carbon, or the application or employment of blast furnaces in the conversion of alkalized matter into cyanides. Secondly,—in the application or employment, in the same manufacture, of kilns or ovens, worked similarly to coke ovens or to lime kilns. Thirdly,—the effecting the cyanizing of the alkali, by disposing and heating it and its associated carbon or fuel in beds or heaps, as hereinbefore described. Fourthly,—the conjoint use of phosphates of lime or other phosphorus compounds along with alkaline matters and carbon for the production of compounds or mixtures of cyanides and phosphorus, as above described."

To GEORGE BEDSON, *of Manchester, for improvements in coating metal with metal and metallic compounds.*—[Dated 10th February, 1857.]

THIS invention relates to that method of coating metal known as tinning or galvanizing, and consists in the application of certain substances floating on the bath of molten metal, and through which the articles are passed. For this purpose, instead of the salammoniac or tallow, commonly used, salts of tin are employed, by preference, the chloride, perchloride, and

sulphate: with these other substances may be combined, for the purpose of causing the metal to run more freely, as, for instance, common salt.

The patentee claims, "the use of salts of tin, for the purpose above set forth."

To JOSEPH SLATTERIE EDWARDS, *of Blackfriars-road, for the preparation and novel application of a certain foreign fruit or vegetable as an article of food or confectionery, or to be used in brewing or distilling, or for the manufacture of sugar and gum.*—[Dated 26th February, 1857.]

THE foreign fruit or vegetable which it is proposed to prepare and apply to the various useful purposes above named, is the *Ceratonia Siliqua,* commonly known as the carob or locust pod, and sometimes called St. John's Bread. This plant or tree grows abundantly in many warm climates, as in Southern Europe, Africa, Asia, and some parts of South America, and has been used in this country, in the raw state, as a nutritious food for cattle, horses, sheep, and other animals.

To prepare the carob as an article of food or confectionery, the bean pod is roasted or dried, and reduced to a fine powder by edge runners or other suitable mill. The meal is then sifted to remove all the stones and husks, after which there may be mixed with the meal a portion of the syrup or saccha, the manufacture of which will be presently described. The mixture or the meal is now reduced to a fine powder, which may be used for making a beverage, or made up into cakes, to be used as chocolate or various articles of confectionery. The bruised, cut, or pulverized carob may also be used, either alone or mixed with ordinary malt, and subjected to the ordinary treatment of the process of brewing from malt only, for the purpose of producing ale or porter; also, for the purposes of distillation, the carob is bruised, and, with or without a mixture of other grain, subjected to the ordinary process of distillation from grain only.

In making liquid sugar, or the saccha syrup from the carob, the pods are ground under edge runners, and the stones, skin, and husk sifted from the meal, which is then mixed with hot or cold water, to form a thick compost. After allowing the mixture to stand for a time, it is put into flannels or other cloths, placed in frames or boxes, and subjected to pressure, which extracts from the mixture or mash a strong syrup; this is taken to a boiling-pan, and evaporated at as low a temperature as convenient, until a strong syrup or liquid sugar is formed, and which may be subsequently crystallized.

To make gum, the residue of the carob, after having been pressed for the purpose of making a syrup of sugar, is roasted, and then boiled, to extract the gum, after which it is strained through a fine sieve, and the liquid evaporated.

With the carob or locust pod, or with the residue from any of the before-named processes of treating the carob—that is, after the extraction of the saccharine or other matters—a nutritious food for cattle is formed, and either with or without a mixture of other pulse or meal. The whole is brought to a thick compost, either by adding hot water or subjecting it to heat, and in that state, it is placed in flannel or other cloths, and subjected to pressure in frames or boxes, and thus formed into cakes.

The patentee claims, "Firstly,—the use of the carob or locust pod as food

and confectionery, as hereinbefore described. Secondly,—the use and application, in the manner described, of the said carob or locust pod, for the purposes of brewing and distilling. Thirdly,—the manufacture of sugar and gum from the said carob, in the manner described. And, fourthly,—the use and application of the said carob, or the residue of the mixtures of the said carob, for purposes of forming cakes as food for cattle, as hereinbefore described."

To JAMES MURDOCH, *of Staple-Inn, for an improved process for imitating the skins of animals upon fulled cloth,—being a communication.*—[Dated 18th March, 1857.]

THE object of this invention is to imitate the skins or fur of animals upon fulled cloth by combining together sundry known processes, which have hitherto been only separately employed. This invention consists principally in printing fulled fabrics before they are dressed or carded, or after a slight carding, for the purpose of smoothing the surface of the stuff as it leaves the fulling mill; then in beating, by means of rods, the printed stuff, in a moist or damp state, to raise the nap, which is then shorn in this state, either slightly (which produces a nap slightly inclined on account of its length) or more deeply, according to the nature of the skin to be imitated. It results from this process, firstly, that the print of the spots, stripes, or other marks imitating the skins of animals has not the strongly defined outline which appears when the printing takes place upon stuffs entirely carded. Secondly, that the regularity of the design is preserved by the beating, contrary to what takes place when, after printing upon carded surfaces, it is attempted to raise, by a supplementary or partial carding, the hairs which have been flattened or gummed by the printing, which produces the inconvenience of a mixture of the unprinted hairs with those which have been printed.

For weaving the material, besides wool, properly so called, may be employed alpaca, cashmere, vigonia, gingerline, and other analogous hair, and sometimes in their natural colors, and therefore with their natural gloss, which is only affected in the printed parts.

The process may sometimes be varied as follows:—Instead of printing the stuff as it comes from the fulling mill, or slightly dressed, to give it a smooth surface, the stuff is completely carded, and then beaten with rods, while in a moist state, which gives an upright nap; it is then left in this state to dry, and is afterwards slightly shorn, to obtain a smooth surface with an upright nap, and then the printing takes place, imitating the spots, stripes, or zebra markings of the animal. The fixing of the impressions is effected in the ordinary manner; and the stuff is then passed through a suitable bath, to unglue or separate those parts of the nap which have undergone the effect of the printing, and to dissolve the gum. The stuff is then submitted to a second but very slight dressing, which not only completes the separation of the hairs, but also removes the remainder of the gum. This operation is followed by a second beating of the stuff in a moist state, the result of which is to raise the nap upright, which is then shorn a second time to a greater or less depth, according to the nature of the skin to be imitated.

Another modification of the invention, which may be applied when it is required to imitate the skins of animals having wavy or frizzled hair, such

as those known under the name of otter's or Astracan fur, is as follows:—Referring to the mode of proceeding above described, after the beating of the stuff in a humid state, an additional operation is performed, known by the name of "the indestructible dressing," and which consists in subjecting the stuff to a strong pressure by means of an hydraulic press, whilst steam is admitted into the pressing table. The object of this process is to crush or flatten the upright hairs; but as these hairs do not all take the same direction as wool, and have naturally a tendency to spread in all directions, the result of the application of the indestructible dressing upon upright hairs, obtained by beating the moistened stuff, is, a surface resembling curling, still-born, Astracan fur, produced by this irregularity in the respective disposition of the hairs among themselves, which the carding or dressing has not been able to overcome, contrary to what takes place with wool.

When employing hair of a fine natural color, the dyeing of these hairs may, in some cases, be omitted, and even the printing; as, for instance, when it is required to imitate otter's skin, or curling, still-born, Astracan fur, by the process above described.

The patentee claims, "the combination of the processes hereinabove described, to obtain as a result the imitation of the skins or fur of animals upon fulled cloth."

To Samuel Campbell, *of Newington, for improvements in preservimg vegetable substances.*—[Dated 19th March, 1857.]

For preserving potatoes, they are first washed and peeled, or washed, boiled, and peeled, as for ordinary use, and then pierced all over, and immediately placed in a solution of salt and water, for thirty minutes, more or less; they are then taken out, and put into a copper containing a solution of pearl barley, say, one quart of bruised pearl barley to ten gallons of water, and left to simmer. After simmering in this solution for about twenty minutes, the potatoes are taken out, and allowed to stand until they are sufficiently cooled, when they are granulated or broken up into small particles, and then exposed, on shallow trays in a drying-room, to a temperature of about 110 degrees Fahrenheit, or otherwise dried; and when sufficiently dry, they may be packed in casks or tins for keeping. Or the potatoes may be cleaned, and then peeled and cut into slices, and placed in the solution of salt and water, as before mentioned, and afterwards placed in the solution of pearl barley, and allowed to simmer for seven or eight minutes, and then taken out and allowed to cool, after which they may be removed at once to a drying-room or apparatus.

For preserving carrots, onions, cabbages, cauliflowers, turnips, beans, peas, &c., a solution of gum arabic and carbonate of soda is used, in the proportion of about one quarter of an ounce of carbonate of soda and two ounces of gum arabic, to every gallon of water. After the vegetables have been properly washed, and such as will admit of it cut into slices or pieces, they are put into bags and immersed in the solution, while boiling, for about five minutes, after which they are taken out and removed to a drying-room or apparatus, and when sufficiently dry, they may be packed for keeping.

The patentee claims, "First,—the employment in the preservation of potatoes, of a solution of pearl barley, in the manner hereinbefore de-

scribed. And, second,—the preserving of carrots, onions, cabbages, cauliflowers, turnips, beans, peas, and other like vegetables, by boiling them in a solution of carbonate of soda and gum arabic, preparatory to drying them, as hereinbefore described, and then drying them."

To WILLIAM EDWARD NEWTON, *of the Office for Patents,* 66, *Chancery-lane, for an improvement in rollers employed for calendering, mangling, and other processes of analagous character,—being a communication.*—[Dated 14th January, 1857.]

THIS invention of an improvement in rollers for calendering, mangling, and other purposes of analagous character, consists in manufacturing these rollers of the husks of maize or Indian corn. The rollers, when made of this material, retain their cylindrical form better, are less affected by wet, and wear smoother than rollers made of cotton, paper, wood, or other materials heretofore used.

The husks may be obtained, in a proper condition to be manufactured into the rollers, in the markets of the United States of America, where they are sold in such condition for the stuffing of mattresses, &c.; or they may be reduced to such state by a process resembling that of heckling flax and hemp, the separation of the fibres being all that is necessary. The process of manufacturing them into rollers is substantially the same as that of manufacturing the cotton rollers heretofore employed for similar purposes. The fibres are taken in a dry state, or only very slightly moistened, and placed in handfuls, without any particular regard to the disposition of the fibres, except to arrange them irregularly in an upright cylindrical vessel, having a stick or rod set upright in its centre, and packed and pressed together, to form what are termed "cheeses," which consist of cylindrical masses, each having a hole in its centre; their cylindrical exteriors being formed by the interior surface of the vessel, and the holes by the central stick or rod. A suitable number of these cylinders or cheeses being obtained, the shaft for a roller, having an iron collar fast near one end, is driven through as many as its length will contain, and the whole are then submitted to pressure in a direction parallel with the axis of the shaft; more cylinders or cheeses being placed on the shaft as those previously placed on are compressed sufficiently to make room for them, until the shaft has received a sufficient number, and the whole are sufficiently compressed. In the above operation, a pressure of from one thousand to two thousand tons must be employed, and the pressure is effected by means of a hydrostatic press. When the fibres are thus brought to a compact and solid mass, another collar is placed on the shaft, and secured to confine them, and the exterior of the mass of fibre is turned off in a lathe, to bring the roller to a cylindrical form of proper size, in the same manner as other calendering rollers are turned, and the roller is then ready for use.

The patentee claims, "the manufacture of rollers, for calendering, mangling, and other operations of similar character, of the husks of maize or Indian corn, instead of cotton, wood, paper, and such other materials as have been previously employed for the purpose."

To Charles Frédéric Vasserot, *of Essex Street, Strand, for an improved paint,—being a communication.*—[Dated 17th January, 1857.]

This improved paint, termed "non-oxyd bronze," is composed of pyrites or sulphides, mixed in certain proportions with vegetable and mineral varnishes. The pyrites or sulphides not being liable to oxidation, form, consequently, a paint resisting the action of sea-water and atmosphere. The minerals employed for this object are reduced into an impalpable powder, and then mixed with varnishes or siccative oils, either vegetable or mineral. The mineral varnish is obtained by melting in equal quantities the pitch with the siccative oil obtained by the distillation of the coal tar.

The paint specially adapted for ships, and which may be applied on wood or iron, as well as on copper, zinc, or sheet-iron sheathings, is composed of 50 per cent. of sulphides, reduced into an impalpable powder, and 50 per cent. of mineral varnish. The 50 per cent. of sulphides are composed as follows:—42 parts of sulphuret of iron, 5 parts of sulphuret of copper, and 3 parts of sulphuret of arsenic (orpiment).

By laying several coats of this paint on the hull of a ship, a thick metallic envelope will be formed of such a solidity that any sheathings will be found unnecessary. This paint will resist the action of sea-water, and prevent the molluscas or other sea insects from clinging to the hull of the vessel, thereby facilitating greatly its propulsion. When sheathings are made use of, a thinner coat of the paint will be applied on them than in the preceding case, and as the paint will preserve from oxidation the materials on which it is applied, sheathings of sheet-iron or zinc will be found as durable as the copper ones hitherto in use. The paint applied on copper sheathings will greatly preserve them, and likewise prevent the molluscas or other animalcula from clinging on their surface, and the same advantage will be obtained by applying it on iron steam-boats.

The paint to be used for buildings or other large constructions is composed of 50 per cent. of sulphuret of iron, reduced into an impalpable powder, and 50 per cent. of mineral varnish.

The mixture of the paint with the mineral varnishes is made in recipients, in which the substances are stirred, by means of an iron rod or shovel, until they are intimately amalgamated, which takes place in about two or three months. Care must be taken to stir often the mixture.

The paint combined with siccative linseed oil and vegetable varnishes is more specially adapted for painting railings, iron doors, street lamp-posts, or any other objects exposed to the rain, and to the influence of the atmosphere. It is composed of 73 per cent. of sulphuret of iron, reduced into an impalpable powder, and 25 per cent. of siccative linseed oil.

The patentee claims "any paint in which the pyrites or sulphides enter either as a principal or accessory, whatsoever be the proportions employed."

To Frederick Crace Calvert, *of Manchester, for the use or application of certain substances in stiffening, sizeing, or otherwise preparing textile fabrics and paper.*—[Dated 20th January, 1857.]

This invention consists in the use of vegetable mucilage as a substitute for, and in the place of, bone or animal size in stiffening, sizeing, or otherwise preparing textile fabrics and paper.

It is well known that the varieties of fustian and stuff goods or paper stiffened with bone or animal size, acquire from that substance a most disagreeable odour, and are, in damp warm situations, liable to undergo a putrefactive fermentation, of which mildew is one of the consequences.

The object of this invention is to substitute for bone or animal size other stiffening fluids, not liable to undergo putrefactive fermentation, or to communicate an unpleasant smell to the above-mentioned fustian or stuff goods and paper. To attain this end, the patentee employs the mucilage contained in flax or linseed, hempseed, the seed of the *Plantago psyillium*, or any other seed which will yield mucilage. He also employs pectic acid, procured from carrots, parsnips, or turnips, or other vegetable matter capable of yielding pectine.

To extract the mucilaginous matter from the above-named seeds and roots, take ten gallons of boiling water, and add thereto twenty pounds of any of the above-named seeds, keeping up the heat for about half an-hour; then filter, to separate the solid matters.

To prepare the pectic acid mentioned, grate the roots of carrots, parsnips, turnips, or other vegetable matter capable of yielding pectid acid, into a pulp; express the juice, and thoroughly wash the mass with pure water; then take 50 parts of the well pressed mass and diffuse them in 300 parts of pure water, adding, gradually, about one part of potash or soda; the whole must now be boiled for about a quarter-of-an-hour, and filtered while boiling hot. The potash or soda is to be next neutralized by adding its equivalent of sulphuric or muriatic acids, and the mucilage or jelly thus obtained is ready for use.

The new mucilaginous fluids may be employed in all cases where bone or animal size is applicable, either to fustian, stuff goods, or paper.

The patentee claims "the use and application of mucilaginous fluid, composed of the materials and prepared in the manner above described, for stiffening fustian, stuff goods, and paper."

To THOMAS JOHNSON, *of Runcorn, Cheshire, for an improvement in purifying alkaline lees.*—[Dated 20th January, 1857.]

THIS invention relates to the purifying of alkaline lees, by applying atmospheric air in numerous streams, forced by an air-pump or blowing-apparatus, through and amongst such lees.

The arrangement of apparatus which it is preferred to use in carrying out this invention is as follows:—A double-acting air-pump, about five feet long and two feet diameter, is employed, and although the piston may be caused to move from end to end of the cylinder, it is preferred to work with a three-feet stroke, and at the rate of about forty strokes per minute. The air-pump has valves applied, as is well understood, in such manner that air may be received into, and forced out from, the cylinder or barrel, alternately at each end. The air forced out of the air-pump alternately at the two ends, is received by a suitable pipe, and is conducted thereby to the vessels in which the impure alkaline lees are contained. The air being thus condensed, is divided into numerous streams, which are allowed to rise up through the alkaline liquor. This dividing of the air into streams is preferred to be done by means of a coil of perforated pipe at the bottom of each of the vessels used; such division of the air into numerous streams

may, however, be accomplished by any other convenient means, so long as the streams are made to pass up through the impure alkaline liquid contained in suitable vessels, and the form of air-pump or air-forcing apparatus may also be varied. The size of vessel which it is preferred to employ is seven feet diameter and four feet deep; in each of which is placed about 800 to 1000 gallons of the impure alkaline liquor. The size of the pump above mentioned is suitable for supplying air to about ten of such vessels, and the purifying process is accomplished in from two to three hours, according to the state of impurity, and the degree of purification the manufacturer may wish to obtain.

In carrying out the invention, it is found advantageous to heat the lees by means of a coil of steam-pipe,—using steam at a pressure of 30 lbs. to 50 lbs. on the square inch. Where the reduction of the strength of the lees is not objectionable, it is preferred that the coil of steam-pipe should be perforated, so as to emit streams of free steam through the lees under process of purification.

The patentee claims, "the application of atmospheric air in numerous streams, forced by an air-pump or blowing apparatus through and amongst such lees."

To ROBERT JOHNSTONE, *of Cambridge-place, St. Pancras, for improvements in the manufacture of fire-wood for lighting fires.*—[Dated 22nd January, 1857.]

THE peculiarity of the invention is in the use of an inflammable composition made from products of tar, which is applied, when rendered fluid by heat, to the surfaces of pieces of ordinary wood as a coating, so that the pieces of wood being piled whilst the composition is hot and fluid, causes the parts to adhere together when cold. The composition should be such as to set hard and dry when cold, so as not to adhere to any surface which the combined fire-wood may come in contact with, after the same has been manufactured, and the composition has set and become cold.

The proportions of the materials used for forming the composition are as follows:—Six parts (by weight) of pitch; one part (by weight) of the salts obtained from dead oil; one part (by weight) of the solid oil obtained from pitch. The pieces of wood, each of which is preferred to be of about half an inch square in cross section, and three or four inches long, are dipped in the composition, and piled or laid on each other in any other desired form suitable for lighting a fire, it being preferred to introduce a small quantity of wood shaving in the interior of each structure. By these means, so soon as the composition is set and cold, the combined or adhering pieces of wood may be freely handled, without adhering to the fingers; and the strength of adhesion of the pieces of wood one to the other, will be such as to keep them together till the whole collection is well ignited. By these means the pieces of wood requisite for lighting a fire will be more cheaply combined into an open structure than when using bindings of string or other mechanical contrivances for fixing the several pieces together; and, by reason of the peculiar composition used, the requisite inflammability of the whole will be obtained, together with a proper adhesion of the several pieces of wood.

To Joseph Glover, *and* John Bold the younger, *both of Liverpool, for improvements consisting of extended uses of photography, as applied to dials, tablets, and pictures.*—[Dated 20th February, 1857.]

This invention consists in printing, by photographic means, impressions of the required appearance upon white or tinted opal glass, or other vitrified substances suitable for forming dials and tablets of every kind, as also for printing thereon, by photographic means, portraits, pictures, and works of art of every kind. The surface or flux of the substance intended to receive the impression is prepared by reducing or deadening the surface by means of fluoric acid, or by grinding; and, finally, the picture or impression is coated with varnish, formed either of shell-lac and alcohol, or otherwise.

In carrying out their invention, the patentees take enamel glass, or glass flushed with opal or colored enamel, enamelled metals, or other suitable mineral substances, and operate upon them in the following manner:—First wash the surface of the material with fluoric acid, to destroy the gloss, and render the same slightly porous and permeable; and when the gloss is entirely removed, wash the surface thus operated upon with water. The material thus prepared is now ready to receive the collodion, albumen, or other substance suited to photographic purposes, and for receiving an image or picture, and it may afterwards be immersed in a nitrate of silver bath or other sensitizing solution; it is then ready for being operated upon in the camera, or for printing upon from a negative picture, or otherwise, and then developed and fixed; all of which processes are well known and commonly practised. Translucent or transparent tablets and dials may be taken on glass or other transparent, semi-transparent, or opaque substances by the above process. By thus preparing the enamelled or other surface, pictures or subjects printed thereon are rendered capable of receiving water colors, oil colors, dry colors, and varnish colors.

The patentees claim, "First,—the extended uses of photography as applied to dials, tablets, and pictures as above stated, and other works of art of every kind, capable of being produced by the above process. Secondly,—the treating or preparing of the surface of the materials of which such dials, tablets, and pictures are made by the use of fluoric acid, as above stated."

To David Baker, *of the Gisbro' Alum Works, Yorkshire, for an improvement in the manufacture of paper.*—[Dated 5th January, 1857.]

The patentee proposes to use a solution of sulphate of magnesia; the paper making in other respects is carried on in the usual manner. Or, in place of using sulphate of magnesia alone, sulphate of alumina may be used therewith, or aluminous clay; in which case, five parts (by weight) of sulphate of magnesia, and fifteen parts of sulphate of alumina, are used, and in some cases a portion of aluminous clay; but other proportions may be used, and sulphuric and muriatic acids may also be employed; in which case it is preferred to use such acid or acids in the proportion of six pounds of the acid of commerce, to 100 lbs. of the sulphates of alumina and magnesia, and of aluminous clay, but the proportions may be varied.

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 248.)

The following paper by Mr. WILLIAM WALLER, of Lincoln, was next read:—"*On the application of steam power to agricultural purposes.*"

II. BARN MACHINERY.

THE steam-engine having been called in to aid the farmer, it has been found, as shewn in the previous paper under the present title,* that an engine on wheels, portable and self-contained, is the most eligible form for that purpose, unless in large farms where a fixed engine might find full employment. The writer proposes now to consider the "Barn Works," or implements employed on the farm, either fixed or portable, and in general use with a steam-engine.

The machinery of a farm may be divided into the following classes, besides the driving power:—the threshing and dressing apparatus for grain, the mill and flour dressing apparatus, and the corn crushing, straw chopping, and root cutting implements.

These are called the barn works, and to them may be added the sawing machinery; but as this is not properly an agricultural implement, though of great service to the farmer, it is passed over. These implements, and the methods in which the work is performed, with a retrospective glance at their earlier history, form the subject of the present paper. The writer, therefore, proposes to review briefly the history of the threshing machine, and, following the grain in its preparation for food, to notice the corn dressing machine, the mill, and the flour dressing machine, as well as the minor auxiliaries of a farm.

Precedence in date of history, as well as in order of process, must be given to the threshing machine. The most important process in agriculture in early times, was the beating of the corn from the husks; and this required more ingenuity than the preparation of the soil in the fertile countries to which the oldest records refer. Mention is made in very early history of the threshing floor, and of threshing instruments of wood and iron, and implements armed with teeth; the flail, drag, and wain, and the method of treading by cattle, are also particularized.

The threshing floor was a round level plot of ground, made hard and smooth, for the purpose of threshing or separating the corn from the straw, by the treading of oxen or other methods.

The flail or staff was used for such grain as was too tender to be treated in other methods.

The drag consisted of a frame of timber or strong planks, roughed at the bottom with hard stones or iron, and was drawn by horses or oxen over the corn sheaves placed upon the threshing floor, the driver riding upon it. In 1848, there was in use in Palestine, a drag or threshing machine composed of two thick planks, fastened end to end, the smaller plank in front being bent upwards; holes were bored in the underside of the planks, and sharp pieces of stone or iron points inserted in them.

* See vol. iv., p. 357, London Journal.

This instrument cut the straw as well as separated the grain from it, and was drawn by oxen, driven in a circle over the grain or sheaves by a man seated upon it; large stones or heavy pieces of wood were also put upon it to increase the weight.

The wain was a similar machine, driven in the same manner, composed of three rollers, armed with iron teeth, or wheels saw-edged all round, to cut the straw. The "*moreg*," as this implement was called, was in use in Egypt in 1838.

Treading the corn was still carried out in 1844, in the South of France, at Avignon, and a similar plan was used in Virginia. The manner of operation is the same as in the other methods; the sheaves are opened and spread out thickly in a circle or ring on the threshing floor, with the ears uppermost, and the animals are driven quickly over by a man in the middle, who guides them by halters, while other men shake up the corn. The floors are from 60 to 100 feet in diameter, and the horse track from 12 to 25 feet wide; the floors are sometimes fenced in, and then the animals are driven loose. The grain, after being thus threshed from the ear, has to be separated from the chaff and dirt, as well as the dung of the animals, whose legs are much injured by the process; the grain is also broken. In the present year, horses and oxen were used in Hungary for treading out the corn; and in one instance, in August last, this plan was being used at the same time as the new finishing threshing machine.

There is another instrument also described as being in use in Syria in 1848,—a kind of sledge drawn by one horse, having a wooden cylinder about 4 feet long and 2 feet diameter, fixed horizontally under a platform mounted upon wheels. On the cylinder, which revolves as a wheel, are fixed, about 1 foot apart, two rows of sharp blades, somewhat like hatchet heads, which turn within 4 inches of the ground. This is driven, by a man seated on it, in a circle or ring over the sheaves of corn; fresh sheaves being constantly fed to it, and the crushed corn gathered up by men on the outside of the ring.

The use of oxen seems to have been almost universal, as well as the system of treading out the corn; but in China this process was generally performed by means of a heavy roller of unpolished marble. In the vicinity of Canton, the flail was used ten years ago, but whence imported is not ascertained. There does not appear to be any trace of the *tribulum* or Roman threshing machine in this country; but the flail (*fustis*) or staff was known to the Romans, and is supposed to have been introduced by them. The fustis is understood to have been a plain rod, similar to that of the Jews, and the loose beater to have been introduced subsequently to the Norman Conquest; the implement then became substantially the same as that now in use.

It will readily be conceived that, in this country, where the flail was in every-day use, and almost the only implement used for threshing, any first attempts at innovation, such as the application of power to attain the same object, would be by means of a similar instrument. Accordingly, in 1732, Michael Menzies, an advocate residing in East Lothian, invented a threshing mill, of which we have but a very rude outline in the "Gentleman's Magazine" for February, 1735. It consisted of a number of flails, fixed in a wooden beam or shaft, which received motion by means of a crank from a water wheel and shaft making about

30 revolutions per minute: the beam is said to have been moved backwards and forwards, with the flails inclined to it at an angle of 10°, but how they were inclined so as to be suitable for working backwards and forwards is not told, and the description is necessarily imperfect. The beam is understood to have been placed across the floor horizontally, for the flails to fall on the straw, and is said to have given 1320 blows per minute; this would then be by means of the rocking motion given to the beam, and dependent upon the number of flails fixed in the beam. The machine is stated to have been fixed at Roseburn, and its description in the "Transactions of the Society of Improvers in the Knowledge of Agriculture in Scotland" is allowed to be the earliest published account of a power threshing machine; it is noticed in Brown's subsequent work on "Rural Affairs," 1811, where it is stated that the force soon broke the flails, and hence the machine did not succeed.

In 1750, Michael Stirling, farmer, Dumblane, invented another machine, having a vertical shaft, with four cross horizontal arms, working in a case 3½ feet high and 8 feet diameter. In this case, the shaft with the arms was turned at a considerable velocity by a water-wheel; and the corn being gradually let down through an opening at the top of the case, the grain was beaten out by the arms, and passed through an opening in the floor along with the straw, from which it was separated by fanners, also worked by the vertical shaft.

In 1772, Ilderton and Smart constructed a machine to act by rubbing the grain from the ears, instead of beating it out. The sheaves were carried between a horizontal indented drum, about 6 feet diameter, and a number of rollers of the same description, ranged round the drum and pressed towards it by springs, in such a way as to rub out the grain when the drum was turned round.

In 1773, a machine, invented by Mr. Osley, at Flodden, was erected for Sir John Delaval. This machine had two fluted feeding rollers; and, instead of a drum, had two sets of arms keyed on a horizontal shaft, the ends of the corresponding arms in each set being connected together by crossbars parallel to the shaft. The scutchers or beaters were formed of two pieces of wood, 3 inches broad by 1½ inch thick at one edge, and ¾ inch thick at the other, and were attached to the crossbars by leather straps. A circular breastwork was placed about 3 inches from the beaters, so as to allow the corn to pass between: the unthreshed corn was laid on a board, at the level of the centre of the beaters, and drawn in by the fluted rollers. The operation was defective and slow, and more expensive than with the flail; the machine was never made public, and its abandonment after trial proved its inutility.

In 1776, Andrew Meikle, a millwright at Houston Mill, Tyningham, East Lothian, attempted to construct a machine similar to that of Menzies, but his plan was soon laid aside. Sir Francis Gilmerton, having seen Ilderton's machine, had a model made under his own directions, which was sent to Meikle, to try by means of the water-wheel at his mill; but the model was torn to pieces in the experiment; and the same fate befel a similar machine of full size subsequently made for one of his tenants,—it could not sustain the requisite velocity and was therefore laid aside. Meikle's attention was then drawn again to the subject, and he concluded that it was necessary to adopt a rotary motion

to beat out the grain, by means of a drum or cylinder, on which were placed beaters, shod with iron. He made a model in 1785, and a machine in 1786, on this principle; retaining the fluted feeding rollers of Osley's machine. This machine was fixed for Mr. Stein, of Kilbeggie, near Alloa, in Clackmannanshire; it may be said to be the parent of our present threshing machines, and is the same which, in an improved form, is now in use.

In 1796, John Steedman, of Toft's Farm, Trentham, Staffordshire, patented a threshing machine, the features of which were a "flail barrel," on which were ten or twelve flails set in motion by the turning of the barrel, the sheaves being placed on a circular moving floor to receive the strokes of the flails. This was the first machine contemplated to be worked by steam, and the writer believes it was so tried; but it did not stand the test of practical working, and thus left Meikle's machine to prove its superiority. Meikle added blowers or fanners to clean or dress the grain; shakers to toss the straw, made like rakes, fixed on drums; gratings for the corn to pass through; and elevators to lift the grain. These are all in use now, and Meikle's was accordingly the *first practical threshing machine* and the *first combined machine.*

Having now brought the threshing machine down to the point where we may assume the principle to be determined and practically developed, the mode of preparing the grain after being threshed presents the next topic for consideration. The earliest method is supposed to have been by tossing the grain in the air, the wind carrying away the chaff, while the grain fell to the ground; and for this purpose the threshing floor was generally situated on high ground, well exposed to the wind. The fan or winnower is specially mentioned, and is supposed to have been a circular hand fan, like a shovel with a handle, as used by the Romans, and still in use in oriental countries to create a current of air. The grain was thrown into the air, or dropped from an elevation, and a current of air, set in motion by the fan, carried off the lighter particles of chaff. Sieves for sifting the corn are also noticed, but in these the corn remained, while the dirt and seeds fell through.

Winnowing machines were first introduced into Scotland in 1710, or soon after, but were not generally known to farmers till 1733; while the vibrating riddle and fanner were brought forward by Dr. Stephen Hales in 1745, in nearly their present form. In the Western Highlands of Scotland in 1849, there was in use a fan or shovel, made of sheepskin, stretched on a hoop about 2 inches deep; two sieves or riddles being also used for the grain. The person using these, holds the sieve up with the corn in it, and wafts the grain with the fan as it falls through, thus driving all light substances away from the heap on which the corn falls.

In 1735, Dr. Desagulier, from Holland, brought under the notice of the Royal Society of London, a contrivance called the "centrifugal machine or bellows," based upon Papin's machine for blowing or extracting air in a continuous blast; and the application of a similar machine to dressing corn is noticed in the "Gentleman's Magazine" for May, 1747.

Dr. Hales, in his work, 1745, describes what he calls a "back heaver," consisting of a riddle, put in motion with a current of air from a fan, similar to the present riddle.

The combined threshing machine consists of machinery to effect the several processes of threshing, shaking, riddling, winnowing, horning, elevating, separating, and sacking by weight, or otherwise; the machine being all carried on one frame, and the whole put in motion by one belt from the engine.

The first portable threshing machine on wheels, driven by steam, was made by Messrs. Tuxford, of Boston, in 1842, with an engine on the same frame, as noticed in the former paper. The first portable *combined* threshing machine was also brought out by them early in 1844, for Mr. George Holland, of Carrington; the combination in this case consisting of one other part besides the threshing drum. Of fixed barn machinery Messrs. Clayton, Shuttleworth, and Co., of Lincoln, with whom the writer is connected, were among the earliest makers; the first fixed machine being made in 1852, previous to which, however, several portable machines had been in effect fixed. In 1854, by a simple contrivance, the corn was dressed twice at one operation in the portable machines constructed by them; and in 1855, the machine was made to finish and dress it for market,—separating the quality of the corn in a manner about to be described, and producing a superior sample. In this way, from time to time, the threshing machine has been modified and improved, and more parts added; and instead of the several processes being performed by so many separate machines, they are now combined on one frame, thus giving the name to the machine.

Of mills and grinding little need be said; the rotary motion seems to have been early adopted, and hand mills were part of the household fittings in the East. Women used to grind, generally two at one mill. Similar mills, called "querns," were in use in Scotland till 1830; and hand mills of a similar description, worked by women, are in use in India in the Hindoo towns and villages, as also in Abyssinia. Little alteration has been made in the plan of doing the work, but steam and other power is now largely applied. Wind power was common in Spain in the sixteenth century, and is supposed to have been introduced into France in the sixth century, for the purpose of grinding corn.

The flour dressing machine was invented in 1675, by John Milne; the earlier method having been to sift it through "bolting cloths." He constructed a cylinder of wire, and claimed the use of brushes, arranged either parallel to the axis of the cylinder, or forming a screw or worm,—the brushes revolving in the cylinder, or the cylinder round the brushes, or both revolving in opposite directions. A brief description of those now in use will be found to be identical with this machine.

In working the portable threshing machine, the sheaves of corn are unbound and passed to the feeder, who stands in the "dicky," and shakes the straw loose into the mouth of the machine; here it meets the drum or beater, revolving at a high velocity, which carries the corn over the concave grating, beating out the grain from the ears. The grain falls through the grating, while the straw is thrown off into a chamber, whence it is taken forward by parallel oscillating bars or boxes, and thrown over the straw board. The shakers, by their motion, also separate the straw, and allow any grain that may have been thrown off from the drum with the straw to fall on to a shogging board, whence, by means of the motion given thereto from a crank-shaft, the grain is passed down to a riddle board, to which an opposite motion is communi-

cated; the two boards advancing to each other or receding simultaneously, both being suspended by links to the framing, and swinging loosely between the sides of the machine. The grain that passes through the concave grating is guided onto the riddle board.

In working the machine, many heads and short straws fall from the grating and shakers, and a coarse riddle or perforated plate is put on the top of the riddle board to take them out from the corn; these "cavings," as they are called, pass over the end of the riddle board, and are then discharged from the machine. The corn, and all smaller substances, chaff, &c., pass through the top riddle and down an inclined board on to a second riddle of a finer mesh; here they meet a blast of air from the fan or blower, which blows away the chaff, while the grain which is heavier falls into a spout, whence it is carried away by an elevator, composed of a number of tins or cans fixed to a belt, which works over tension pullies. The spout of the threshing machine delivers the corn into the bottom shoe of the elevator; and the cans being carried round by the rotation of the belt, discharge it into a spout, whence it passes to the next process.

From this spout the grain is delivered into the hopper of the corn dressing machine, and thence through a barley horner, which subjects it to the action of a number of knives fixed on a spindle, and loosen the husks or whites of the wheat, and cut the ears or horns off the barley. Independently of the inclined position of the barley horner, the grain is kept in motion by the "set" of the knives, which are in a spiral form. Motion is given to the spindle by a pulley fixed on the end.

The grain and loose ears pass from the barley horner into the mouth of the dressing machine, and are met in their descent by a current of air from a fan or blower, which clears the grain of all chaff and ears that may have been left in it; the grain falling upon an inclined board is conducted to a riddle, which is carried upon links, and receives motion from a crank. Any stones or ears that may have got in are here taken out, and passed over the riddle into a spout, and discharged from the machine through a delivery spout. The grain, on falling through the riddle, is caught by a fine wire sieve, through which all small seeds pass, and are carried also to the delivery spout. The grain, passing over this sieve, is swept by a current of air taken from the back of the blower, and effectually cleaned of any light seeds that may be too large to pass through the sieve, and also of any chaff that may have been loosened from the grain by the riddling. The grain is guided to the mouth of a revolving cylindrical sieve or screen, through the meshes of which the small imperfect corn, or "light" corn, falls into the first spout; the mesh now widening, allows the broken corn and a larger size, or "tail" corn, to fall through into a second spout, while nothing but the best corn can find its way out of the end of the cylinder to the third spout. A simple apparatus is here fixed, consisting of a weighing machine, with rods and bell cranks, so arranged as to shut off the delivery and ring a bell when the scale falls. A bushel of corn weighs 60 lbs., and four bushels make a sack; and the weight of the sack itself being 7 lbs., 247 lbs. is therefore the weight to be put in the scale; and the empty sack is held open to the spout by means of rods fixed on this scale of the machine. When the four bushels of corn are delivered, the scale falls, loosing the catch of the slide, which immediately shuts, and

allows a bell, that has hitherto rested upon the top of it, to swing clear and ring, thus calling the attendant to put a fresh sack on and re-open the slide.

The whole process, from the time when the corn in the straw is fed to the threshing machine, to the time when the grain, dressed and sorted for market, is sacked in half-quarter quantities, is thus entirely self-acting; and in this time the following separations are made:—straw—cavings—chaff—seeds—light corn—tail corn—best corn,—besides dust, which must inevitably be mixed up with the straw at first, and which is blown away in the process.

The portable threshing machine is now so arranged as to combine the dressing and separating process with the threshing and winnowing in one machine; and a brief description will suffice to explain the arrangement. The riddle boards are divided longitudinally and vertically into two parts, as is also the fan or blower, thus forming two distinct sets of blowers and riddles. The corn, passing through the first set, arrives at the spout, as before described, from which it is taken up by elevators and passed into the hopper of a barley horner. It is thus passed to the other side of the machine, where it falls down in front of the second half of the divided blower, upon the new or second set of riddles, down to a second spout on the other side of the machine. It is here again taken up by another set of elevators, and discharged into a hopper, whence it passes through the revolving screen, and is separated and delivered as before.

The action of threshing is still supposed by many to be a continuous series of *blows;* by others, to consist of *rubbing* between the beaters and the surface of the breastwork; and by others, again, to be the combination of the two actions. In the present machines in this country the straw is fed across the drum, so as to allow the drum to "bolt" it, or carry it through without twisting or breaking the straw, which is with many farmers a serious consideration. In the old machines, and in the present American machines, the straw is broken up by means of pegs on the drum and breastwork; but as the Royal Agricultural Society take notice of the state of the straw, whether it is broken or not, it has become an object to preserve it.

The next process through which the grain has to pass is grinding, breaking, or kibbling, as it is called, according to the degree of fineness of the meal required. Several methods have been proposed, but the old plan of one stone revolving above another, which is fixed, is still found as good and economical as any. The corn being fed into the hopper is shaken down the spout by the damsel working against the spout, into the eye of the upper or running stone, whence it gets into the furrows of the two stones, and passes out from them as meal into the mill-stone casing, from which it is carried off by a spout. The object of portable corn mills on farms is to break wheat, barley, oats, &c., into meal for food for man and beast; it is only worked occasionally, and therefore no arrangements for cooling the flour and meal are provided. Several mills, with iron and steel plates, edge-stones, &c., have been introduced, shewing great ingenuity, but they are unavoidably passed over in the present paper.

The flour dressing machine consists of a case containing an inclined cylinder of wire gauze, of various degrees of fineness. On a spindle,

passing along the centre of this cylinder, are fixed, by means of arms keyed on it, a set of brushes, which revolve rapidly at about 300 to 500 revolutions per minute. The meal or broken corn is passed into one end of the cylinder, and the fine flour falls at once through the wire into the first compartment; by means of the brushes and alterations in the gauge of the wire, five or six separations are made, which are called in some—superfine—seconds—thirds—fine sharps—coarse sharps—bran;—in other machines they are called—fine—seconds—thirds—stuffings—fine bran—bran;—each having five riddlings and the husks or bran. The best corn makes the best description of flour, the tail a coarser sort, and the light corn coarser still; the seeds remain as food for poultry, or to be thrown away.

The smaller implements mentioned before as forming part of the barn works, are of modern introduction, and have been brought forward by science to assist the practical agriculturist. The following list includes those in most general use:—

Linseed and Corn Crushers.
Chaff Cutters or Straw Choppers.
Turnip Cutters and Root Cutters.
Gorse Crushers or Cutters.
Oilcake Crushers or Breakers.

The linseed and corn crushers have been introduced to effect a saving in the quantity of corn necessary for animals, as the crushing or bruising ensures the whole of the nutriment contained in the grain being rendered available, instead of the animal swallowing the food without properly masticating it. The process is simple; the grain is merely passed between plain or grooved rollers, crushing, not grinding, being the object; the bulk is thereby increased at least one-third, and its nutritive power in the same ratio. This idea is really of very old date, though only of recent adoption, having been recommended by Hartlib in 1650.

The chaff-cutters are made with two or more knives, shaped concave or convex towards the edge, and fixed on a shaft carrying a fly-wheel. A feed motion is attached, to bring the straw or hay up to the knives; the straw being placed in a box, and the knives working across the end of the box and close against it. The length of the cut is variable, and may be altered from about ¼ inch to 3 inches by adjusting the amount of the feed.

Turnip cutters are discs, arms, or plates of metal, with knives or cutters to pare or slice turnips or other roots, which lie against the knives by their own weight. The roots are cut in slices for cattle, and in strips for sheep; cross cutters being then introduced.

Gorse crushers are made with toothed rollers to bruise the gorse for feeding beasts, which eat it with avidity; it is crushed by the machine to a harmless pulp, and cut into short lengths.

Oilcake breakers are made with toothed rollers, by which the cake is taken hold of and broken; the cut being adjusted by set screws, so as to regulate the degree of fineness required, according as the cake is being broken for cattle or sheep. The dust from the cake passes through a grating.

The results of experience with the several machines have led to the

adoption of the following speeds of working as the most eligible for the purpose:—The speed of the drum of the threshing machine is found to be best at about 5000 feet of the circumference per minute. The straw shaker should pass the straw at the rate of 75 to 80 feet per minute. The shogging board and riddle board should be worked at about 200 revolutions of the crank per minute. The blowers should run at about 2000 feet of the circumference per minute. The barley horner spindle should make 400 to 500 revolutions per minute. The elevators should work at 100 to 150 feet per minute; but the rate is dependent upon the quantity to be taken up, and it may sometimes be found necessary to quicken the speed.

The best speed of a 3 feet stone for a mill similar to the one described is found to be about 140 to 150 revolutions per minute; or about 1400 feet per minute of the circumference, instead of 1550 to 1600 feet per minute, as given by the ordinary rule; the lower speed giving the greatest quantity of work done for the least amount of power expended. The smaller machines are not so delicate in their operations, and are more dependent upon the kind of stuff they are fed with, and the state it is in, and therefore do not allow of any fixed rule, although each maker recommends a particular speed.

The growth of the threshing machine having been traced from its simple to its complete form, as now in use, an interesting experiment may be mentioned, which was tried at the meeting of the Yorkshire Agricultural Society, at Ripon, in 1854, to ascertain the power consumed by the several parts of the machine.

A combined fixed machine, with a dressing apparatus, as before described, made by Messrs. Clayton, Shuttleworth, and Co., required 6·15 horse-power to drive it when at work, and 1·77 horse-power when empty, leaving 5·38 horse-power available for doing the work. This machine threshed 200 sheaves of wheat in 13·80 minutes, and the power expended was accordingly 6.15 horse-power for 13·80 minutes, equivalent to 34·87 horse-power for one minute; or, multiplying by 33,000, and dividing by 200, the power expended was 11,004 units of power to thresh one sheaf of wheat (one unit of power being one pound weight raised one foot high). The 1·77 horse-power required to drive the machine when empty was divided as under:—

Dressing Machine	·37 horse-power.
Elevator	·11
Shaker and Riddle	·28
Blower	·20
Drum and Shafting	·81
Total	1·77 horse-power.

The power expended in threshing one sheaf of wheat has been gradually increased from about 6000 units in the earlier machines, by the additions in successive years of farther apparatus to render the process more complete, several operations being combined in the one machine.

Taking a similar basis of calculation, the power required to work the portable corn-mills and smaller barn implements, as reduced from the average results of the trials at the Show of the Royal Agricultural Society, in 1855, is as follows:—

Portable Corn Mills,	**about 9000**	**units,**	**to grind 1 lb. of corn.**
Corn Crushers,	— 3600	—	to crush 1 lb. of linseed or oats.
Chaff Cutters,	— 2200	—	to cut 1 lb. of chaff.
Turnip Cutters,	— 150	—	to cut 1 lb. of turnips.
Oilcake Breakers,	— 180	—	to break 1 lb. of cake for cattle.
	— 350	—	to break 1 lb. of cake for sheep.

The cost of threshing by flail, added to the cost of leading the straw, &c., from the stack to the barn, was 3*s*. 5*d*. per quarter of corn, in 1851, as reported by Mr. Pusey, from his own knowledge, and at the prices and rates he was himself paying. In threshing with horse machines, the cost was reduced to 2*s*. per quarter; but with the engine and portable threshing machine the cost of "barning" is done away with, and the expense—allowing 7*s*. per day for the use of the machine, wear and tear, &c.—was reduced to 9*d*. per quarter; showing the important saving of 62 per cent. over the horse machines, and 78 per cent. over the hand threshing. A subsequent trial was made at Beverley, in 1851, when the actual cost was reduced to 7*d*. per quarter, still leaving 7*s*. per day for the machine; but the nett cost of threshing and finishing a quantity of corn, in the method described previously, may be said to be now 8*d*. per quarter; this sum including all expenses of dressing the corn for market.

A trial of threshing machines took place in Kent, in April last, when one machine threshed, without finishing, about 21½ quarters of wheat, with 350 lbs. of coal, in 3½ hours; while another machine, having extra machinery attached to it for finishing, threshed and finished for market, in the same time, about 25½ quarters, with 563 lbs. of coal, and that under disadvantage, owing to very high wind, and the windy side of the stack having fallen by lot to it. A stack of barley was threshed and finished by the second machine in 7¾ hours, including stoppages amounting to 1¼ hour, making the actual time 6½ hours; in this time the machine was found to have yielded 73 quarters of barley, or at the rate of 11·23 quarters per hour: the engine employed was of 7 horse-power.

The following paper, by Mr. Robert Morrison, of Newcastle-on-Tyne, was next read:—"*Description of an improved steam pile driver.*"

The time required for all large works in the vicinity of water is very much increased by the tedious process of pile driving. When it is recollected that an ordinary pile driving machine, with four men, will rarely drive more than one pile in a day and a half, putting in 1000 piles by this means becomes a lengthy process, and costs in wages alone nearly £800. To reduce in some measure both the time and expense, it is customary to use a small steam-engine, and to connect to it the chains running from a number of the old hand pile drivers; but here, although labour certainly is saved, yet the original machine remaining the same, no additional speed is attained.

Upon the commencement of the extensive dock works by the River Tyne Commissioners, at Hay Hole, near Newcastle, contracted for by Mr. Thornbury, this difficulty was practically met by the introduction of a direct steam pile driver, designed by the author, of great power, capable of driving a 14-inch square pile 35 feet in 12 minutes in very

difficult ground: in fact, since it has been in operation, the mere driving of the piles has been but a small item in the time; getting up the piles, pointing, and preparing to drive them, now cause the principal delay; and accordingly 21 piles per day are as much as the machine has usually driven. But from what can be done when piles are ready and quickly brought up, there is little doubt but that the machine could easily drive from 30 to 36 piles in 10 hours. The attendance required is very trifling; namely, one engineman, one stoker, and two assistants for pitching the piles; the amount of wages being thus the same as for one single hand machine, with the exception of a few shillings more given to the engineman, whilst the work done is more than 30 times as great, and upon ground on which no hand pile driving machines could make any impressions at a depth of more than 16 feet.

The whole of the apparatus forming the new steam pile driver, including the auxiliary engine, boiler, and lifting tackle, is carried upon one moveable platform, mounted on eight wheels, which move as the work progresses along rails laid on the piles already driven. Upon this framework are erected two strong uprights, well and securely fitted together, and serving as guides to the hammer cylinders; and on the top of each of these uprights are two chain pulleys. The larger ones are used for raising the hammer cylinders and placing them on the top of the piles, and the smaller ones for raising and placing the piles themselves; the machinery and gearing for this purpose being driven by a small engine. The pile is made round at the top, and hooped, having a shoulder to receive a collar, to which are attached four columns, carrying the cylinder of the driver or hammer. The piston-rod of this cylinder is made large, and forms the weight, and being in one piece with the piston is perfectly secure against all liability to breakage. The cylinder is guided by brackets, which embrace iron plates, attached to the strong uprights. The steam is conveyed from the boiler to the slide-valve case by a jointed steam-pipe, which allows the cylinders to move up and down, as the height of the piles may require.

When it is desired to put the machine in operation, an auxiliary engine is connected, by means of a clutch, to the barrels, from which the chains pass to the larger pulleys before mentioned, and the hammer cylinders are lifted to the top of the uprights by the chains, and there held from moving by a break; the gearing is then disconnected from these chain-barrels by the clutch, and applied to smaller barrels, on which are wound the chains that pass over the smaller pulleys at the top of the uprights, and are attached to the piles. The chains being now wound up, will raise and place in the position the piles required to be driven. This done, the cylinders are lowered, so that the collar of each fits on the rounded head of the pile, and rests upon the shoulder; the whole weight of the cylinder is then allowed to rest on the pile, while the strokes of the piston-rod or hammer-bar cause the pile to descend, the suspending chain being then left slack, so as to allow the cylinder to descend with the pile as it is driven.

The apparatus for working the hammer-bar is very simple, and consists of an ordinary slide-valve enclosed in a valve-box; the valve-rod being connected to a volute spring, the pressure of which tends to hold the valve open, so as to admit the steam into the bottom of the cylinder to raise the hammer-bar. The bottom of the hammer-bar has a catch, which

strikes an arm when the hammer rises, and draws the valve-rod down, thereby shutting off the steam from the cylinder, and allowing the steam that has just performed the up stroke to escape; at the same time a small catch slips into a notch in the the top of the valve-rod, and holds the valve shut, until the hammer has descended and struck the pile. The concussion of the blow causes a kicker at the top of the hammer-bar to release this catch, and the pressure of the volute spring raises the valve, admitting the steam under the hammer, ready for another stroke The process is continued in this manner until the pile is driven deep enough. The auxiliary engine is then put into gear with spur wheels on one of the axles of the running wheels, and thus the whole machine is caused to advance. The hammer-cylinders are then lifted again, and another couple of piles is raised and placed; and so on, till the work is completed.

In consequence of having separate gearing for raising the piles and the cylinders, the piles can be raised up preparatory to pitching, while those previously placed are being driven. Two or more such machines may be used together, or one only employed; and the piles may be driven either upright, or at an angle, by altering the uprights as circumstances may require; when at an angle, the steam should be used on both sides of the pistons.

The auxiliary engine is so arranged that the connecting-rod works through a flat elongated trunk, fixed to the piston, and passing through a stuffing-box in the bottom of the cylinder. The piston has also a round trunk projecting through the top of the cylinder, which serves as a means of lubricating the end of the connecting-rod, and is made of such size that the effective area of the bottom side of the pistons shall exceed the effective area of the top side of the piston by such an amount, that the weight of the piston, with trunks and connecting-rod, complete, may be correctly balanced, taking into consideration the pressure of steam intended to be used. The boiler is of the vertical description, with a single conical fire-box, nearly equal in size at the bottom to the diameter of the boiler, and at the top, equal to the diameter of the chimney. This boiler has been found to answer very well.

The advantages of the steam pile driving machine above described are, that the ram, piston, and rod, are made in one solid piece, 10½ inches in diameter, so that there is no possibility of breaking them; and being arranged to work through both ends of the cylinders, they require no other guides. Also the ends of the ram and pile are always exposed to view, and can at any time be got at without taking any of the parts to pieces. In the ordinary forms of the machine, on the other hand, the ram is made of a large square block of cast-iron, secured to a small piston-rod, 2½ inches in diameter; this rod again has to be secured to the piston in the cylinder; and a round face has to be keyed on the end of the square metal ram, to drive the pile, making in all three joints, all of which are a source of trouble, by getting loose and breaking. The square metal block or ram has to be guided in a box or trunk, made of boiler plate, and bolted together, so that the ram and gearing are hidden from view, as well as the end of the pile; and when anything gets wrong, the whole has to be taken to pieces, before it can be seen and remedied.

The blow from the new machine is much more effective than that of

a short hammer-block of the same weight, as the piston-rod or ram is a bar 12 feet long, weighing 35 cwt., let fall $3\frac{1}{2}$ feet on end, instead of a bar 4 feet long and the same weight, let fall the same height; the blow of the long bar on end being found to be one-half more effective.

Lastly, this machine drives two or more piles at the same time. It has a clear fall of 3 feet 6 inches, with a weight of 35 cwt. It is carried upon the piles already driven, and does not require two extra rows of temporary piles to be driven, in order to carry it, as in ordinary machines; which, when one pile is driven, require to be shifted sideways to drive the other, besides being shifted forwards.

In answer to an enquiry of the Chairman, Mr. Bunning said, that the machine had been in constant work for nine months, during which time the whole pile driving on which it was employed, had been completed. The contractor had at one time thought he should not be able to get through his contract from the very slow progress made by the hand pile driver; but, by the aid of the machine, he had accomplished the work much more rapidly than was expected.

The Chairman observed, that the present machine appeared similar in action to Nasmyth's steam pile driver, except that the cylinder was now made to rest upon the pile, so as to go down with it.

Mr. Bunning said that the action was similar, so far as regarded the use of a direct-acting steam hammer; but there was an advantage in the arrangement of the present pile driver, whereby it required no other support than the permanent piles already driven, and was capable of driving two piles at once, thus greatly expediting the work. The pile driver was a modification of the steam-hammer invented by Mr. Morrison, which had been described at a previous meeting.

PROVISIONAL PROTECTIONS GRANTED.

[*Cases in which a Full Specification has been deposited.*]

2410. John Smith Barden, Aaron Watkins Rockwood, Holmes Hinkley, and Daniel Franklin Child, all of the United States of America, for certain improvements in engines for hydraulic or various other useful purposes,—being a communication.—[*Dated September 17th.*]

2508. Rudolph Bodmer, of Thavies-inn, for improvements in machinery or apparatus for winding, unwinding, reeling, cleansing, measuring, sorting, weighing, twisting, and doubling silk, and other fibrous substances,—being a communication.—[*Dated 29th September.*]

2558. Jonathan Parker, of the state of Maine, U.S.A., for certain new and useful improvements in machinery for grinding card cylinders for carding engines.—[*Dated October 6th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1648. Jules Clovis Dieulafait, of Paris, for an improved method of manufacturing garments, whereby one garment may be changed in form to that of several others.—[*Dated June 12th.*]

1670. William Smith, of Salisbury-street, Adelphi, for improvements in chromotypographical printing presses,—being a communication.—[*Dated June 15th.*]

1678. William Smith, of Salisbury-street, Adelphi, for improvements in steam generators,—being a communication.—[*Dated June 16th.*]

1938. Hippolyte Lamy, of Paris, for an engine or apparatus for obtaining motive power by an improved method of applying steam, gas, or heated air.—[*Dated July 11th.*]

1995. Alexander Whyte, of Glasgow, for an improved mechanical arrangement for weaving.—[*Dated July 20th*]

2030. Thomas Williams, of Aberdaron, Carnarvonshire, North Wales, for an improvement in the construction of ships or vessels, whereby their draught may be regulated.—[*Dated July 24th.*]

2032. William Johnson, of Stockport, for improvements in looms for weaving.—[*Dated July 25th.*]

2152. Robert Wagstaff, of Mottram-in-Longdendale, Cheshire, for certain improvements in locomotive engines to be employed on common roads or ways, applicable to agricultural and other similar purposes.—[*Dated August 12th.*]

2189. Hugh Pritchard Hughes, of Coetmor, Carnarvonshire, for improvements in the construction or arrangement of a rock boring machine.—[*Dated August 18th.*]

2225. Jules Dufau, of Paris, for improvements in regulating or controlling railway and light-house signalling. [*Dated August 21st.*]

2243. John Gedge, of Wellington-street, for improvements in envelopes for letters and other documents,—being a communication.—[*Dated August 25th.*]

2264. John Webb, of Bristol, for an improved hopper.—[*Dated August 26th.*]

2270. John Henry Christian Löbnitz, and James McLintock Henderson, both of Renfrew, N.B., for improvements in steam-engines.—[*Dated August 27th.*]

2276. John Muckart, of Montrose, N.B., for improvements in effecting the combustion of fuel, and the consumption or prevention of smoke; applicable to boiler furnaces.—[*Dated August 28th.*]

2290. Thomas Bradford, of Salford, for certain improved apparatus for washing clothes or articles of wearing apparel, which apparatus is also applicable to churning.

2292. Henry Rawson, of Leicester, for an improvement in machinery for combing wool and other fibres.

2294. Thomas Gray, of Richmond-street, Southwark, and George Joseph Gladstone, of Blackwall, for improvements in apparatus for lowering and letting go ships' boats.

2295. Robinson Elliott, of South Shields, for improvements in photography, by which the lensular defects of the present processes of taking photographic prints are avoided, and impressions are obtained of any size.

2296. Ephraim Taylor, of Blackburn, for improvements in looms.

2298. Rudolph Sack, of Loeben, near Luetzen, Prussia, for improvements in the construction of ploughs.

The above bear date September 1st.

2302. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for certain improvements in meters for gas and other fluids,—being a communication.—[*Dated September 2nd.*]

2304. George Frederick Parnell, of Hoxton, for improvements in the construction of hooks and eyes.

2306. Thomas Jackson, of Orchard-street, Portman-square, for improvements in the action of piano-fortes.

2308. Perry G. Gardiner, of New York, for new and useful improvements in the conical coiled steel rail-road car spring, and also of new and useful machinery, for preparing, coiling, and converting steel plates or bars into such springs, and for testing and measuring the strength of such springs.

The above bear date September 3rd.

2310. John Yuil Borland, of Manchester, for improvements in machinery for preparing, spinning, winding, and doubling fibrous materials.

2311. Louis Moreau, of Paris, for improvements in apparatus for carbonizing peat, wood, and other combustible matters.

2312. Prosper Bernard Godet, of Paris, for improvements in stereoscopes.

2313. Tony Petitjean, of Hatton-garden, for an improved method of obtaining aluminium and magnesium.

a short hammer-block of the same weight, as the piston-rod or ram is a bar 12 feet long, weighing 35 cwt., let fall 3½ feet on end, instead of a bar 4 feet long and the same weight, let fall the same height; the blow of the long bar on end being found to be one-half more effective.

Lastly, this machine drives two or more piles at the same time. It has a clear fall of 3 feet 6 inches, with a weight of 35 cwt. It is carried upon the piles already driven, and does not require two extra rows of temporary piles to be driven, in order to carry it, as in ordinary machines; which, when one pile is driven, require to be shifted sideways to drive the other, besides being shifted forwards.

In answer to an enquiry of the Chairman, Mr. Bunning said, that the machine had been in constant work for nine months, during which time the whole pile driving on which it was employed, had been completed. The contractor had at one time thought he should not be able to get through his contract from the very slow progress made by the hand pile driver; but, by the aid of the machine, he had accomplished the work much more rapidly than was expected.

The Chairman observed, that the present machine appeared similar in action to Nasmyth's steam pile driver, except that the cylinder was now made to rest upon the pile, so as to go down with it.

Mr. Bunning said that the action was similar, so far as regarded the use of a direct-acting steam hammer; but there was an advantage in the arrangement of the present pile driver, whereby it required no other support than the permanent piles already driven, and was capable of driving two piles at once, thus greatly expediting the work. The pile driver was a modification of the steam-hammer invented by Mr. Morrison, which had been described at a previous meeting.

PROVISIONAL PROTECTIONS GRANTED.

[*Cases in which a Full Specification has been deposited.*]

2410. John Smith Barden, Aaron Watkins Rockwood, Holmes Hinkley, and Daniel Franklin Child, all of the United States of America, for certain improvements in engines for hydraulic or various other useful purposes,—being a communication.—[*Dated September 17th.*]

2508. Rudolph Bodmer, of Thavies-inn, for improvements in machinery or apparatus for winding, unwinding, reeling, cleansing, measuring, sorting, weighing, twisting, and doubling silk, and other fibrous substances,—being a communication.—[*Dated 29th September.*]

2558. Jonathan Parker, of the state of Maine, U.S.A., for certain new and useful improvements in machinery for grinding card cylinders for carding engines.—[*Dated October 6th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1648. Jules Clovis Dieulafait, of Paris, for an improved method of manufacturing garments, whereby one garment may be changed in form to that of several others.—[*Dated June 12th.*]

1670. William Smith, of Salisbury-street, Adelphi, for improvements in chromotypographical printing presses,—being a communication.—[*Dated June 15th.*]

1678. William Smith, of Salisbury-street, Adelphi, for improvements in steam generators,—being a communication.—[*Dated June* 16*th*.]

1938. Hippolyte Lamy, of Paris, for an engine or apparatus for obtaining motive power by an improved method of applying steam, gas, or heated air.—[*Dated July* 11*th*.]

1995. Alexander Whyte, of Glasgow, for an improved mechanical arrangement for weaving.—[*Dated July* 20*th*]

2030. Thomas Williams, of Aberdaron, Carnarvonshire, North Wales, for an improvement in the construction of ships or vessels, whereby their draught may be regulated.—[*Dated July* 24*th*.]

2032. William Johnson, of Stockport, for improvements in looms for weaving.—[*Dated July* 25*th*.]

2152. Robert Wagstaff, of Mottram-in-Longdendale, Cheshire, for certain improvements in locomotive engines to be employed on common roads or ways, applicable to agricultural and other similar purposes.—[*Dated August* 12*th*.]

2189. Hugh Pritchard Hughes, of Coetmor, Carnarvonshire, for improvements in the construction or arrangement of a rock boring machine.—[*Dated August* 18*th*.]

2225. Jules Dufau, of Paris, for improvements in regulating or controlling railway and light-house signalling. [*Dated August* 21*st*.]

2243. John Gedge, of Wellington-street, for improvements in envelopes for letters and other documents,—being a communication.—[*Dated August* 25*th*.]

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2310. John Yuil Borland, of Manchester, for improvements in machinery for preparing, spinning, winding, and doubling fibrous materials.

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2312. Prosper Bernard Godet, of Paris, for improvements in stereoscopes.

2313. Tony Petitjean, of Hatton-garden, for an improved method of obtaining aluminium and magnesium.

2314. Charles William Ramié, of Camberwell, for improvements in constructing the permanent ways of railways.

2315. Jacques Alexandre Farrier, of Paris, for improvements in transparent photographic pictures, and their application to stereoscopes.

2316. James Robertson, of Kentish Town, for improvements in furnaces, and in the consumption or prevention of smoke.

2317. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improvement applicable to rolls for rolling iron or other metals,—being a communication.

2318. Archibald Turner, of Leicester, for improvements in the manufacture of elastic fabrics.

2319. James Nuttall, of Silver-street, and Louis Stean, of Goswell-street, for improvements in fur gloves.

The above bear date September 4th.

2320. Uriah Scott, of Camden Town, for improvements in machines for cleaning knives.

2321. Thomas Bent Wilkins, of Birmingham, and Thomas Milward, of Harborne, Staffordshire, for certain improvements in the combination of dies for stamping belt fastenings, and which said improvements are also applicable to the stamping of other such like articles or ornaments.

2322. Richard Johnson, of Blackburn, for certain improvements in purifying and filtering water.

2323. John King, of Cannon-street, for improvements in the manufacture of boots and shoes, and in machinery for that purpose,—being a communication.

2324. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in clocks or time-keepers,—being a communication.

2325. William Edward Newton, of the Office for Patents, 66, Chaucery-lane, for improvements in the manufacture of a composition to be employed in the preparation of pigments,—being a communication.

2326. Henry Archer, of Gloucester-street, Pimlico, for improvements in envelopes.

2327. Peter Armand le Comte de Fontainemoreau, of Paris, for an improved timekeeper dial, shewing the exact time in different countries,—being a communication.

The above bear date September 5th.

2328. Spilsbury Butler, of Birmingham, for a new or improved hearse.

2329. Peter Armand le Comte de Fontainemoreau, of South-street, for improvements in doors,—being a communication.

2330. Andrew Walker, and Thomas Walker, both of Shotts, Lanarkshire, N.B., for improvements in the treatment or preparation of moulds for casting metals.

2331. Thomas Goodchild, of Guildford, Surrey, for improvements in stoves and fire-places.

2332. William Lewis, and William Henry Lewis, of New York, for improvements in plate-holders or frames for photographic cameras.

2333. William Sellers, of Philadelphia, U.S.A., for improvements in boring or turning mills for operating in metals or stone.

2334. Benjamin Parker, of Hammersmith, for a new elastic composition for coating, cementing, bedding, and otherwise protecting bodies; also applicable to the construction or formation of articles to which it may be suitable.

2335. Constant Jouffroy Duméry, of Paris, for improvements in smoke-preventing apparatus.

2336. Uriah Scott, of Camden Town, for improvements in boots and shoes, applicable in part to shoes for horses.

2337. Louis Alexis Imbert, of Trevilly, France, for an iron straight-edge holder, designed for strengthening walls, edges, or mouldings.

The above bear date September 7th.

2338. George Josiah Mackelcan, of Falcon-street, London, for improvements in floating docks.

2339. George John Parson, of Adelphi-terrace, Strand, and Thomas Pilgrim, of Bow, for improvements in the mode of generating steam in the boilers of steam-engines, and in raising the temperature of steam for other uses.

2341. Benjamin Sharpe, of Hanwell Park, for improvements in electric telegraph cables, and in the apparatus used for paying out such cables.

2342. John Marland, of Fernlee-vale, Saddleworth, Yorkshire, for an improvement in the manufacture of cop tubes.

2343. James M. Miller, of Washington, U.S.A., for a surface condenser, applicable to steam-engines and other purposes.

2344. William Geach, of Prospect-place, Falmouth, for improvments in machinery for propelling vessels.

2345. William Howard, of Great Queen-street, Lincoln's-inn-fields, for improved apparatus for supplying air, medicated or pure, to persons in confined apartments, and other places requiring ventilation.

The above bear date September 8th.

2346. Stanislas Hoga, of Charlotte-street, Fitzroy-square, for improvements in apparatus for generating electricity, and for transmitting electric currents from place to place.

2347. Louis Letournel, of Paris, for an apparatus for weighing ships' anchors.

2348. Alexander Hédiard, and Sénateur Levieux, both of Paris, for an improved boiler for generating steam.

2349. Leon Louis Honoré Bertou, of Rue d'Hauteville, Paris, for improvements in the manufacture or production of ornamental wrappers or packings for fabrics or other goods.

2350. Edward Lavender, of Aston-street, Limehouse, for an improvement in distilling products from coal.

2351. James Eastwood, of Derby, and Samuel Lloyd, of Wednesbury, for improvements in machinery for shearing iron and other metals.

The above bear date September 9th.

2352. Joshua Butters Bacon, of Brunswick-square, for improvements in machinery for manufacturing horse-shoe nails,—being a communication.

2353. Henry Lawford, of Berners-street, for an improvememt in the manufacture of dining tables, expanding and contracting tops; applicable also to other expanding and contracting planes.

2354. John Leslie, of Glasgow, for improvements in carding or preparing textile materials,—being a communication.

2355. John Honeyman the younger, of Glasgow, for improvements in generating steam.

2356. Marin Joseph Alphonse Mille, and François Canal, both of Paris, for improvements in producing gas.

2357. William Jamieson, of Ashton-under-Lyne, for certain improvements in looms for weaving figured fabrics.

2358. James Fenton, of Low Moor, William Thompson the younger, of Wakefield, and Thomas Snowdon, of Middlesboro'-on-Tees, all in Yorkshire, for improvements in the permanent way of railways.

2359. Richard Houchin, of Bridport-place, Hoxton, for an improved press for punching, stamping, and embossing, or otherwise for cutting out paper, leather, or other materials, and for fixing and closing eyelets.

2360. William Clark, of Chancery-lane, for improvements in Jacquard apparatus and in the pattern surfaces of such apparatus,—being a communication.

2361. John Dearman Dunnicliff, of Nottingham, for improvements in dividing and measuring breadths of lace and other fabrics.

2362. James Harrison, of Red Lion-square, for improvements in apparatus for producing cold by the evaporation of volatile liquids in vacuo.

2363. William Crofts, of Lenton-terrace, Nottingham, for improvements in the manufacture of various weavings in bobbin net, or twist-lace machinery.

2364. Gustave Brüninghaus, of Dortmund, Prussia, for improvements in the treatment of iron ore (crude iron) for the production of iron and steel.

The above bear date September 10th.

2365. Marc Antoine François Mennons, of Paris, for an improved smoke-condensing apparatus,—being a communication.

2366. Thomas Silver, of Philadelphia, U.S., for a machinery or apparatus for regulating or governing the paying out or delivery and the laying down of submarine or oceanic telegraph cable, parts of which are also applicable for taking and recording soundings, and for other purposes.

2367. James Mills, of Manchester, for certain improvements in the manu-

facture of "keys," "tapered pins," "split pins," and other similar articles employed in the construction of machinery.

2368. William Porter Mc Callum, of Birmingham, for improvements in machinery used for stamping or raising metals.

2369. Aristide Michel Servan, of Paris, for improvements in the cementation of iron, combined with the manufacture of coke.

2370. Simeon Colbeck, and William Henry Colbeck, both of Batley, Yorkshire, for improvements in looms.

2371. Charles Lungley, of Deptford-green Dock-yard, for improved apparatus for directing, signalling, and indicating on board ships or vessels, or other places.

The above bear date September 11th.

2372. Nicholas Fisher, of Milton, Northamptonshire, for improvements in machinery combining operations in preparing land for agricultural purposes.

2373. Nicolas Gustave Imbert de Laphalèque, of Paris, for improvements in violins and other stringed musical instruments of a similar nature.

2374. Charles Watson, of Alfred-place, Bedford-square, for an improved apparatus for curing certain bodily complaints.

2375. John Butler, and Joseph Pitts, both of Stanningley, Yorkshire, for an improvement in fastening tyres on wheels for railway carriages.

2376. John Edwards, of Aldermanbury, London, for improvements in railways to facilitate locomotive engines ascending inclines.

2377. Isidore Charles Clöet, of Ghent, for machinery or apparatus for treating and dressing rice.

2378. James Leeming, of Bradford, Yorkshire, for improvements in looms for weaving.

2379. William Gossage, of Widnes, Lancashire, for improvements in the manufacture of soda and potash.

The above bear date September 12th.

2380. Thomas Waterhouse, of Sheffield, for certain improvements in machinery or apparatus for applying steam and atmospheric air to actuating and governing forge and other hammers.

2381. Theophilus Marsh, of Pond's Works, Sheffield, for an improved piston,—being a communication.

2382. William Jenkins, of Miles Platting, near Manchester, for improvements in the furnaces or fire-boxes for locomotive boilers, to adapt them for the consumption of coal and the smoke arising therefrom.

2383. Alexander Gray, of Glasgow, for improvements in the picking motion of power looms.

2384. David Thorpe Lee, of Birmingham, for a new or improved washing machine.

2385. John Sleddon, and Joseph Marsland, both of Oldham, for improvements in preventing incrustation in steam-boilers.

The above bear date September 14th.

2386. Alexander Gray, of Glasgow, for improvements in lubricating mechanism.

2387. Richard Shiers, jun., of Oldham, for improvements in the manufacture of velvets.

2388. John Ashby, of Croydon, for machinery for cleaning wheat and other grain or seed from smut and other injurious matters.

2389. John Walmsley, and Thomas Howard, both of Accrington, for improvements in machinery or apparatus for warping, sizing, or dressing and winding on yarns or threads.

2390. Thomas Grahame, of Leamington, for improvements in grinding corn and in generating gas on inland waters.

2391. Gerd Jacob Bensen, of Christian-street, St. George's-in-the-East, for an improvement in drying sugar.

2393. Adrien Jules Alexis Dumoulin, of Paris, for improvements in heating apparatus.

2394. Thomas Robson, of Critchill-place, Hoxton, for improvements in washing machines.

The above bear date September 15th.

2395. Thomas Sidebottom Adshead, of Staly Bridge, Cheshire, and John Platt, of Oldham, for certain improvements in machinery for carding cotton and other fibrous materials.

2396. Prosper Bernard Godet, of Paris, for a new mode of illustrating literary productions.

2397. Richard Wicks, of Phœnix-street, Somers Town, for improvements in furnaces.
2398. George Davies, of Serle-street, for improvements in the manufacture of cloth or woven fabrics composed of a mixture of wool and a vegetable filamentous material not hitherto used for such a purpose,—being a communication.
2399. Abram Seward, and Charles Seward, both of Lancaster, for an improved boiler for heating and keeping up circulation in water.
2400. Charles William Lancaster, of New Bond-street, for an improvement in breech-loading guns, and in projectiles for the same,—being a communication.
2401. Alphonse René Le Mire de Normandy, of Judd-street, and Edward Thornhill Simpson, of the Calder Soap Works, Wakefield, for improvements in the manufacture of soap.
2402. John Hathornthwaite Winder, of Sheffield, for improvements in rotary steam-engines and pumps.
2403. William Middleton, jun., and Thomas Tertius Chellingworth, both of Birmingham, for certain improvements in adjusting the sliding parts of chandeliers and gas-pendants.
2404. Richard Brown, of Glasgow, for improvements in moulding or shaping metals and other materials.
2405. Robert Garrard, of Loman-street, Southwark, for improvements in the manufacture of japanned straw hats.
2406. Peter Armand Le Comte de Fontainemoreau, of Paris, for an improved railway brake,—being a communication.
2407. Emile Alcan, of Fore-street, for an improved process of refining paraffine,—being a communication.

The above bear date September 16*th.*

2408. Johan Ernst Fridrich Luedeke, of Birmingham, for a new or improved motive-power engine.
2409. Edward Hayes, of Stoney Stratford, for improvements in winding apparatus for hauling ploughs and other agricultural implements.
2411. Isac Louis Pulvermacher, of Paris, for improvements in apparatuses for creating electric currents, chiefly for medical purposes.
2412. George Frederick Hack, of Hackney, for an improved cigar tube or holder for smoking cigars or tobacco.
2413. Hugh Greaves, of New Palace-yard, Westminster, for improvements in constructing the permanent ways of railways.

The above bear date September 17*th.*

2414. William Smith, of Salisbury-street, Adelphi, for a novel machine or apparatus for engraving the metallic surfaces of printing rollers or cylinders,—being a communication.
2415. Benjamin Burleigh, of Great George-street, Westminster, for improvements in the mode of laying submarine telegraphs.
2416. John Webb, of Bristol, for an improved chaff cutter.
2418. Robert Watson Savage, of St. James's-square, for an improved spring and appliances (for carriages and vehicles), which can also be adapted to use on shipboard, or otherwise to maintain the equilibrium of articles placed on a platform provided with the said improved spring and appliances.
2419. Daniel Imhof, of Oxford-street, for certain improvements in machinery adapted to the exhausting or forcing of air, gases, or vapour, and in the application of such machinery to various useful purposes.
2420. Charlotte Delevante, of Kimbolton-place, Brompton, for improvements in bouquet-holders.
2421. Samuel Whitehead, of Bury, Lancashire, for improvements in trousers, as part of male attire.
2422. Samuel Faulkner, of Manchester, for certain improvements in machinery or apparatus for carding cotton and other fibrous substances.
2423. Richard Watson, of Galashiels, Selkirk, N.B., for improvements in weaving.
2424. Richard Watson, of Galashiels, Selkirk, N.B., for improvements in the manufacture of heddles or healds for weaving.
2425. Thomas Wilson, of Bradmore House, Chiswick, for an improved boot and shoe cleaning apparatus.
2426. David Lichtenstadt, of Castle-street, for improvements in the manufacture of pulp of which paper and other fabrics are composed.

2427. Sir James Caleb Anderson, of Fermoy, Ireland, for improvements in locomotives and other carriages.
2429. Henry Saxon Snell, of Chancery-lane, for improvements in apparatus for retarding omnibuses and other carriages.
2430. Thomas Webster, of Paris, for improvements in the permanent way of railways,—being a communication.
2431. John Watson Burton, and George Pye, both of Ipswich, for improvements in the construction of rollers used for pressing fabrics, and fibrous and other materials.
2432. Henry Bessemer, of Queen-street-place, for improvements in the manufacture of cast steel.
2433. Arthur Rigg, senior, and Arthur Rigg, junior, both of Chester, for improvements in preparing, sawing, planing, grooving, tongueing, moulding, mortising, and tenoning wood; part of which is applicable to preparing other vegetable substances.

The above bear date September 18th.

2434. William Naylor, of Bradford, Yorkshire, for improvements in power looms for weaving worsted, cotton, silk, woollen, and other fibrous substances.
2435. Montague Richard Leverson, of St. Helen's-place, for improvements in the preparation of food for cattle,—being a communication.
2436. François Cavaleri, of Paris, for improvements in motive power engines.
2437. William Henry James, of the Old Kent-road, for certain improvements in steam vessels; parts of which improvements are applicable to sailing and other vessels.
2438. Richard Archibald Brooman, of Fleet-street, for a method of decomposing soapy wash waters, used in the washing and scouring of wools and cloths, of separating therefrom fatty matters held therein, and of treating such fatty matters,—being a communication.
2439. William Henry Peake, of Liverpool, for improvements in the construction of beams, girders, and bridges.
2440. William Thomas Eley, of Broad-street, Golden-square, for improvements in percussion caps.
2441. Henry Ormson, of Stanley Bridge, King's-road, Chelsea, for an improvement in the manufacture of cast tubular boilers.
2442. John Minnitt, of Nottingham, for an improvement in extracting grease from animal refuse resulting from the manufacture of glue and from fell-mongers' processes.

The above bear date September 19th.

2443. Pierre François Joly, of Paris, for improvements in apparatus for generating and superheating steam.
2444. Robert Gray, of Sheffield, for an improved band or cord, to be employed for distending or expanding skirts or similar wearing apparel.
2445. George Schaub, of Birmingham, for a new or improved manufacture of rollers or cylinders, with patterns or designs thereon, for printing fabrics and other materials.
2446. Louis François Picot, of Toulon, for improvements in salinometers or instruments for indicating the saturation of water in marine boilers.
2447. Edmund Lloyd Owen, of Wolverhampton, for a new or improved method of propelling vessels.
2449. John Absterdam, of Massachusets, U.S.A., for a certain new and useful improvement in electric telegraph cables.
2450. John Paterson, of Wood-street, for an improvement in clasps, buckles, and other like fastenings.

The above bear date September 21st.

2451. Daniel Forrester, of Forest-villa, Mortimer-road, Kingsland, for an improved fastening for securing watches, &c., worn on the person, whereby the same are rendered safe from robbery; to be called "Forrester's patent watch and property protector."
2452. George Jarvis Worssam, of Oakley-crescent, City-road, for an ink self-supplying pen-holder.
2453. Meinrad Theiler, of North-terrace, Westminster-road, for a direct printing telegraph, without relays and local battery,—being a communication.
2454. Michael Henry, of Fleet-street, for improvements in the mode of transmitting motion, especially applicable to apparatus employed in navigation,—being a communication.
2455. John Ford, of Stepney, for an

improved apparatus for marking or scoring at whist and other games, which may be adapted for otherwise assisting the memory of the players.

2456. Ramsey Lawson, of Manchester, for certain improvements in apparatus for regulating the admission of air to furnaces.

2457. Hesketh Hughes, of Wellington-street, for improvements in machinery for cutting, embossing, and stamping.

2458. George Rennie, of the Albion Iron Works, Holland-street, for improvements in vessels for war and revenue purposes.

2459. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in obtaining photographic pictures,—being a communication.

2460. William Edward Newton, of the the Office for Patents, 66, Chancery-lane, for improved machinery for forging metals,—being a communication.

2461. William Stettinius Clark, and Benjamin Moore, both of High Holborn, for improvements in machines for cutting splints for friction matches,—being a communication.

2462. Alfred Count de Bylandt, of Michael's-grove, Brompton, for improvements in propelling ships or other navigable vessels.

The above bear date September 22nd.

2463. Frederick Collier Bakewell, of Haverstock-terrace, Hampstead, for improvements in the preparation for use of caustic alkalies,—being a communication.

2464. Pierre Oury, of Hatton-garden, for an improved apparatus and method for impressing or marking figures or designs upon silk, cotton, or other suitable substances employed for lining caps, hats, and other similar articles.

2465. Peter Armand Le Comte de Fontainemoreau, of Paris, for an improved method of marking paper for postal purposes,—being a communication.

2466. Adam Murray, and William Pollard, both of Bradford, near Manchester, for improvements in the manufacture of textile fabrics.

2467. John de la Haye, and Mark Bloom, both of Salford, near Manchester, for improvements in laying down submarine telegraphs.

2468. William Power, of Rotherhithe, for improvements in steam-engine boiler furnaces and other furnaces for smoke prevention.

The above bear date September 23rd.

2469. William Beckett Johnson, of Manchester, for improvements in raising and lowering trucks, carriages, engines, or other such railway appendages from one level to another.

2470. Thomas Singleton, of Over Darwen, for improvements in looms.

2471. Augustin Vrain Adrien Laugère, of Orleans, for improvements in windmills.

2472. Thomas Saunders, of Pump-row, Old-street-road, for an improved tumbler key and lever tumbler lock.

2473. Abraham Booth Patterson, of Baltimore, U.S.A., for an improved mode of laying submarine cables.

The above bear date September 24th.

2474. John Barber, of Manchester, for improvements in machinery or apparatus for manufacturing rollers or cylinders used for printing and embossing woven fabrics, paper, leather, and other materials.

2475. John Kelshaw, and John Wilkinson, both of Elland, Yorkshire, for improvements in self-acting couplings for railway carriages and engines.

2476. Leopold Newton, of Oldham, for improvements in the mode of placing tubes on the spindles used in spinning machinery.

2477. John Fortescue, of Charles-street, Middlesex Hospital, for improvements in the construction of domestic or other fire-places, for the purpose of consuming smoke and saving fuel.

2478. James Gregory, of Bitton, Gloucestershire, and William Craymer, of Bristol, for feathering and adjusting screw propellers to be used in propelling vessels.

2479. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in rock-drilling machinery,—being a communication.

2480. James Jackson, of St. Seurin-sur-l'Isle, Gironde, France, for improvements in the manufacture of tyres for railway and other wheels.

2481. John Chubb, of St. Paul's Church-yard, for improvements in the construction of iron safes and doors for strong rooms.

2482. Boydell Robinson, of Gilbert-street, Grosvenor-square, for improvements in the bodies and jackets of ladies' dresses.

The above bear date September 25th.

2483. Pascol Balboni, of Florence, for a marine, submarine, and aerostatic propeller, being a new mechanism for propelling steam vessels on and in the water; applicable also to aerostatic purposes, combining speed and safety in steam-boats, and giving the power of directing balloons.

2484. Joseph Lewis, of Salford, for certain improvements in machinery or apparatus for making bricks, tiles, and other similar articles; and also in the machinery for preparing clay for the same manufacture.

2485. Richard Watson, of Galashiels, Selkirk, N.B., for improvements in weaving.

2486. Michael Henry, of Fleet-street, for improvements in the manufacture of artificial wine, vinegar, and brandy, part of which improvements is applicable in the manufacture of brandy generally,—being a communication.

2487. George Speight, of Woodbridge-street, Clerkenwell, for improved head plaits, foundations for wigs, bracelets, and other plaited ornaments for personal wear.

2488. Thomas Crick, and John Throne Crick, both of Leicester, for improvements in the manufacture of boots, shoes, and slippers.

The above bear date September 26th.

2489. James Broad, of Drury-lane, for the construction of a lamp with two burners and two wicks, to produce one flame or two flames, according to its regulation by generation of gas, from all and every sort of oils or spirits, naphthas, resinous and tarry substances, and also from petroleum or earth oils.

2490. Robert Kay, of Castleton Print Works, near Rochdale, for improvements in machinery or apparatus for printing calico and other textile fabrics.

2491. George Roby, of Wigan, Lancashire, for improvements in machinery or apparatus for raising water and employing the same as a motive power.

2492. William Bestwick, of Salford, near Manchester, for an improved material suitable for skirt springs and other similar purposes.

2493. William Bowler, of Bristol, for improvements in the manufacture of hats and other coverings for the head.

2494. Richard Quin, of Rodney-street, Pentonville, for improvements in the construction of cases suitable for containing photographic and other pictures.

2495. Edouard Marcellus Blount, of Paris, for improvements in distilling.

The above bear date September 28th.

2496. Earle Harry Smith, of New York, for improvements in sewing machines.

2497. Emile Albert Lejeune, of Paris, for an improved crupper,—being partly a communication.

2499. William Bayliss, of Monmore-green, Wolverhampton, for certain improvements in the manufacture of chain cable.

2500. Stephen Smith, of Manchester, for certain improvements in coffins,—being a communication.

2501. Richard Archibald Brooman, of Fleet-street, for improvements in raising and lowering weights and bodies in mines and other like places, in ventilating mines, and other like places, and in extracting water therefrom,—being a communication.

2503. John Charles Pearce, of Bowling, near Bradford, Yorkshire, for improvements in apparatus used in hot pressing, and in the means of manufacturing parts of such apparatus.

2504. James Welch, of Southall, Middlesex, for improvements on carriages and portable railways, to facilitate their movement on common roads and other surfaces.

2505. Samuel Clarke, of Albany-street, Regent's-park, for improvements in apparatus for burning night lights or mortars.

2506. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved apparatus for igniting gas or other lamps,—being a communication.

2507. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved apparatus for

measuring gas,—being a communication.

The above bear date September 29th.

2509. John Henry Johnson, of Lincoln's-inn-fields, for an improved hand-saw,—being a communication.

2510. Auguste Bouret, of Paris, for improvements in Pecqueur's loom for manufacturing fishing and other nets.

2511. George James Wainwright, and Charles Timothy Bradbury, of Dukinfield, Cheshire, for improvements in machinery, or apparatus for making or manufacturing tubes or partial tubes used in spinning and doubling machinery and for holding the same ready for use,—part of which machinery is applicable to making pens, pen-holders, and similar purposes.

2512. James Paisley, of Hele Works, Devon, and George Bertram, of Edinburgh, for improvements in the manufacture of paper.

2513. Edwin Thompson, and William Joseph Nicholson, both of York, for an improvement in railway switches.

2514. Christopher Crabb Creeke, of Bournemouth, Hants, for improvements in the construction or manufacture of earthenware pipes.

2515. Joseph Firth, of Crosland Moor, near Huddersfield, for an improvement in metallic pistons.

2516. William Sandilands, of Inveresk, Mid-Lothian, N. B., for improvements in chimney cans or apparatus for promoting draught in chimneys.

2517. William Henderson, of Bristol, for improvements in treating certain ores and alloys, and in obtaining products therefrom, and in recovering or reproducing all or part of the materials used.

2518. James Harris, of Hanwell, for improvements in, and connected with, cocks and valves, especially adapted to preventing the bursting of water pipes from frost.

The above bear date September 30th.

2519. James Ward, of Church-street, Liverpool, for improvements in pumps applicable for mines, ships, and other purposes.

2520. James Long, and Joseph Long, both of Little Tower-street, for an improved method of, and apparatus for, ascertaining and registering the depth of water and the pressure of steam.

2521. Evan Leigh, of Manchester, for certain improvements in machinery or apparatus used in spinning and preparing cotton and other fibrous substances, parts of which are also applicable to machinery or apparatus generally.

2522. Josiah George Jennings, of Holland-street, Blackfriars, for improvements in the manufacture of articles used for forming flues and air and water passages in buildings.

2523. James Murdoch Napier, of Vine-street, York-road, for improvements in printing machines.

The above bear date October 1st.

2525. Luigi De Cristoforis, of Milan, for regulating the ascent and descent of the railway locomotives on inclined plans, which is to be called the "De Cristoforis ascending and descending locomotive apparatus."

2526. Samuel Davies, of Brilley, Herefordshire, for improvements in apparatus for heating the feed-water of steam boilers.

2527. Alfred Illingworth, and Henry Illingworth, both of Bradford, Yorkshire, for improvements in machinery or apparatus for combing wool and other fibrous substances.

2528. Henry John Childe Shakespear, Captain, H.E.I.C.S., for an improvement in the structure of carriages for military and other purposes.

2529. John Sweet Willway, of Bristol, for an improved apparatus to act as a gas valve.

2530. George Webster Shibles, of Thomas Town, Maine, U.S.A., for improvements in arranging and reefing the sails of ships.

2531. Peter Kerr, of Paisley, for improvements in preparing and finishing threads or yarns.

2532. Joseph England, of Beverly, Yorkshire, for improvements in washing machines.

2533. Alexander Macpherson, of Carstairs, Lanark, N.B., for improvements in the manufacture of fences.

2534. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the construction of iron bridges,—being a communication.

The above bear date October 2nd.

2535. Robert Green, of Crawshaw Booth, near Rawtenstall, for improvements in raising or forcing liquids.

2537. William Riley, and Thomas Riley, both of Greetland, near Halifax, Yorkshire, for certain improved means, machinery, or apparatus for "saving" or covering the lists of textile fabrics previous to the dyeing of such fabrics.

2538. John Atherton Molineaux, and Joseph Nichols, both of Brighton, for improvements in pistons for steam-engine and other cylinders.

2539. George Chowen, of Exeter, for improvements in the arrangement and construction of fog, wreck, and other buoys.

2540. Augustus Seyferth, of Paris, for the employment of sulphuret of carbon for motive purposes, and engines and apparatuses for applying and regenerating the same.

2541. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for certain improvements in machinery for making mould candles,—being a communication.

2542. William Pursall, of Birmingham, for improvements in the manufacture of eyelets.

2543. John Stobbs, and George Roger Hall, both of North Shields, for improvements in pumps for raising water and other liquids.

The above bear date October 3rd.

2544. George Duncan, and William John Jellicorse, of Litchfield-street, Birmingham, for an improved smoke-consuming furnace.

2545. John Rubery, of Birmingham, for improvements in the manufacture of certain parts of umbrella and parasol furniture.

2546. Charles Reeves, of Birmingham, for a new or improved sword.

2547. William Richardson, of Ranelagh-grove, Pimlico, and George Richardson, of Copenhagen-street West, Islington, for partly or wholly stopping wheels of carriages of every description when in motion; and such break or breaks to be applied by the motive power.

2548. Robert Atkinson, of Newcastle-on-Tyne, for improvements in garments as part of male attire.

2549. George Davies, of Serle-street, for improvements in the combustion of coal without smoke, which improvements are also applicable to the combustion of other kinds of fuel,—being a communication.

2550. Michael Henry, of Fleet-street, for improvements in apparatus or machines for raking and scraping or cleaning roads, streets, ways, and places,—being a communication.

2551. Louis Beckers, of New York, for improvements in apparatuses for exhibiting daguerreotype, photographic, and other stereoscopic views and pictures,—being a communication.

2553. John Penford Harvey, of Spalding, for improved machinery for crushing land or clods.

2554. Athanase Victor Constant Regnauld, of Paris, for a universal preservative medicine.

The above bear date October 5th.

2556. John Talbot Pitman, of Gracechurch-street, for improvements in apparatus for making candles and other analogous manufactures,—being a communication.

2557. Richard Hugh Hughes, of Hatton-garden, for improvements in hydraulic connections of gas chandeliers, lanterns, or pendants.

2559. Edward Vigers, of Bayswater, for improvements in the construction of wrought-iron beams and girders.

2560. Richard Archibald Brooman, of Fleet-street, for improvements in apparatuses for taking photographic pictures,—being a communication.

2561. Conrad William Finzell, of Bristol, and James Bryant, of Plymouth, for improvements in cleansing animal charcoal, and in removing iron and other impurities therefrom.

2562. James Stoneham, of Audenshaw, near Manchester, and John Pipler Lees, of Ashton-under-Lyne, for improvements in uniting or connecting piping.

2563. George Thomas Robinson, of Leamington Priors, Warwickshire, for a machine for obliterating postage stamps on letters, at the same time time stamping the post marks and registering the number of letters so stamped.

2564. William Knapton, of the Albion Foundry, Monkbar, Yorkshire, for improvements in gasometers or gas-

holders, and in the application thereof to railway and other carriages and ships, for lighting the same with gas.

2565. Augustus Applegath, of Dartford, for improvements in printing machines.

2566. James Warburton, of Low Mills, Addingham, Yorkshire, for improvements in combing wool and other fibres.

2567. Ebenezer Stevenns, of Cambridge-road, Middlesex, for improvements in machinery for making bread and pastry, and other similar articles.

2568. Robert Romaine, of Beverly, Yorkshire, for improvements in machinery for digging or cultivating land; part of which improvements is applicable to agricultural steam-engines generally.

2569. William Gossage, of Widnes, Lancashire, for improvements in the manufacture of sulphuric acid.

The above bear date October 6th.

2570. Alexander Boyd, of Lees Brook, near Oldham, Lancashire, for improvements in machinery for spinning and doubling.

2571. Thomas Forsyth, of Manchester, for improvements in the construction of metallic pistons.

2573. Job Allen, of Commercial-road, and John Young, of Shadwell, for improvements in preventing oscillation in carriages upon railways.

2574. Thomas Grubb, of Dublin, for an improved photographic lens.

2575. Charles Barlow, of Chancery-lane, for improvements in buoyant or life-preserving garments,—being a communication.

2576. William Mac Naught, of Rochdale, and William Mac Naught, of Manchester, for improvements in steam-engines.

2577. William Grindley Craig, of Gorton, Lancashire, for improvements in the manufacture of railway carriage and other wheels formed of cast metal, or having cast metal naves or bosses.

2578. Daniel Reuver, of Boulevart de Waterloo, Brussels, for improvements in propelling and steering ships and other floating bodies.

2579. James Cocker, of Liverpool, for improvements in the manufacture of wire.

2580. William Richard Todd, jun., of Hull, for improvements in manufacturing or preparing washing blue.

2581. James Cocker, of Liverpool, for improved apparatus for heating or annealing wire, wire iron, or rods or sheets of iron or other metals.

2582. Elbridge Foster, of the State of Connecticut, U.S.A., for a new and useful or improved life preserving berth for navigable vessels.

2583. Thomas Massey, of Birchin-lane, and Thomas Savage, of Soley-terrace, Pentonville, for an improvement in apparatus for ascertaining and recording the speed of ships.

2584. James Wadsworth, of Hazelgrove, near Stockport, for improvements in the production and management of artificial light and heat, and in certain parts of apparatus applicable thereto.

The above bear date October 8th.

2585. George Scott, of Philadelphia, U.S.A., for improvements in steam generators.

2586. Samuel Walmsley, of Heaton Norris, for improvements in the construction of footsteps for upright shafts and spindles.

2587. Fennell Herbert Allman, of Mornington-place, Regent's-park, for certain improvements in the construction of valves and taps.

2588. Richard Davies, of Newcastle-on-Tyne, for improvements in washing machines.

2589. John Harland, of Newcastle-on-Tyne, for improvements in purifying and cleansing clay, and in the manufacture of bricks, tiles, and similar articles therefrom.

2590. Antoine Marie Poisat, of Paris, for a machine for preparing wood to be reduced into pulp for the manufacture of paper, card, and pasteboard,—being a communication.

2592. Henry Brown, and William Brown, both of Albert-street, Newington Butts, for an improved whip socket.

2593. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in stirrups or stirrup irons,—being a communication.

The above bear date October 9th.

2594. Charles Barnard, and John Bishop, both of Norwich, for an improved washing machine.

2595. Francis Alton Calvert, of Manchester, for improvements in machinery for ginning cotton and for burring and cleaning cotton, wool, and other fibrous materials.

2596. George Miller, of Salford, for improvements in apparatus for heating and ventilating.

2599. Alfred Barlow, of Leeds, for a Jacquard apparatus, dispensing with the use of cards, and the usual mode of designing for figured weaving.

2600. William Henry Myers, of Whitechapel-road, for an improved means for signals on railways,—being a system of signals for railway trains in motion or otherwise, comprising communications between guards and engine-drivers, station-masters, and others; the same apparatus being applicable as fog, danger, and accident signals; the same apparatus being also a communication from station-masters or their servants, including point and signal men, to guards and engine-drivers for passengers by means of glass or metallic pendant signals.

2601. Robert Porter, and James Porter, both of Blackburn, for improvements in machinery for the manufacture of bricks.

2602. Richard Ussher, of Rath Boro, Wexford, Ireland, for a machine for imparting motive power to thrashing machines and such like agricultural implements.

2603. Henry Edwards, of Dalston, for an improved vessel or feeder for administering food and medicines.

2604. Frederck Mortimer Butler, of New York, for improvements in ventilators or wind guards for chimneys and other purposes.

The above bear date October 10th.

2605. Franklin Prestage, of Westbury, Wilts, for improvements in the furnaces of locomotive and other steam boilers.

2606. John Gray, and John Wilson Gray, both of Rathgar, Dublin county, for an improved means of causing signals to be made on railways, and of otherwise preventing certain classes of accidents on same.

2607. George Beard, of Pall Mall, for improvements in mechanism for producing impressions on paper or other surfaces.

2608. Vincent Wanostrocht, of St. Swithin's-lane, for improvements in converting muskets and other fire-arms into rifled fire-arms,—being a communication.

2609. William Calvert, of Residentiary Houses, St. Paul's, for improvements in obtaining motive power by the action of the wind.

The above bear date October 12th.

2611. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved apparatus for roasting or torrefying coffee or other substances,—being a communication.

2613. Michael Henry, of Fleet-street, for improvements in apparatus for playing loto,—being a communication.

2617. John Harwood Simpson, of Petersham, Surrey, for improved machinery or apparatus for making bands or ropes of straw, hay, or other fibrous substances.

2619. Vincent Wanostrocht, of St. Swithin's-lane, for improvements in obtaining fatty and oily matters by distillation,—being a communication.

2621. William Sharman, of Sheffield, for an improved metallic compound applicable to the manufacture of various useful and ornamental articles.

The above bear date October 13th.

2623. Edward Keighley, of Bradford, Yorkshire, for improvement in the preparation and use of dye liquids.

2625. John Field Swinburn, of Birmingham, for improvements in fire-arms,—being a communication.

2627. Edward Owen, of Blackheath, for improvements in the preparation and manufacture of manures.

2629. John Middleton, of Hyde, Cheshire, and William Rylance, of Whitefield, near Manchester, for the application of a certain metal or material to the manufacture of shuttles, bobbins, and tubes.

The above bear date October 14th.

New Patents.

Sealed under Patent Law Amendment Act, 1853.

1857.

744. C. & J. Askew, and H. Myers.
811. John Sherar.
815. T. M. Smith and C. Burke.
825. Thomas Lawes.
827. W. H. Collins.
828. Thomas Lawes.
831. John Hewitt.
834. Reuben Sims.
841. J. W. Wilson.
845. W. T. Clark.
849. A. F. Butler.
852. James Morris.
855. E. Von Löwenstein.
861. Charles Martin.
864. David Thomson.
866. Ferdinand Jossa.
869. H. B. Girard.
870. L. E. Deplanque.
873. A. Nield and N. B. Sutcliffe.
875. David Jack.
886. George Hamilton.
891 John Graham.
897. B. H. Paul.
901. Robert Adam.
904. Robert Wardell.
906. Henry Smith.
909. John Oliver.
916. Duncan Morrison.
917. Edwin Maw.
918. Robert Otway.
920. R. A. Brooman.
922. W. Hardman, and J. Dugdale.
927. R. A. Brooman.
928. John Smith.
932. Thomas Whitehead.
933. F. M. Baudouin.
935. John Bourne.
939. E. Adler and F. B. Howell.
942. Charles Renshaw.
944. J. Milnes and F. W. Mowbray.
948. J. H. Johnson.
951. J. H Johnson.
954. W. Perks, jun.
957. Thomas Melling.
964. John Slack.
966. Charles Goodyear.
972. J. G. Hunt.
973. J. T. Pitman.
974. G. Pearson and E. Jessop.
676. John Robinson.
977. Edward Finch.
980. Henry Brierly.
981. F. Piercy and S. Flagg.
984. R. K. Bowley.
985. B. Hingley and S. Hingley.
987. J. B. Sparke and A. Sparke.
989. E. Edwards andE. Beacher.
990. C. T. Bright.
992. J. W. Rogers.
993. A. V. Newton.
1000. Thomas Rolfe.
1003. E. P. Alexander.
1004. C F Bielefeld.
1006. G. E. Taylor.
1010. John Leach.
1011. J. Beech and J. Williams.
1012. J. C. Haddan.
1013. J. C. Haddan.
1016. William Smith.
1020. H. F. Courenq.
1024. R. A. Brooman.
1028. T. N. Pengelly and G. Porter.
1031. Josiah Gimson.
1035. Joseph Maurice.
1036. T. Richardson and E. J. J. Browell.
1039. W. E. Newton.
1040. A. E. Schmersahl.
1045. Charles Barlow.
1046. P. Mc Farlane.
1047. John Ramsbottom.
1048. Robert Hazard.
1049. P. Wicks and T. G. Ghislin.
1052. Thomas Harrison.
1054. The Earl of Aldborough.
1055. Robert Knowles.
1060. W. E. Newton.
1062. Robert Knowles.
1064. Louis Barnett.
1065. A V. Newton.
1067. B. F. Brunel.
1068. James Payne.
1070. Jacob Safran.
1072. J. Sudbury and A. W. Linsell.
1074. T. and F. Sugden.
1076. William Weild.
1077. Robert Hindle.
1078. T. L. Scowen.
1080. James Warburton.
1081. Johnson Hands.
1082. James Warburton.
1084. James Warburton.
1087. George Schaule.
1088. Edward Oldfield.
1090. J. M. L. Caillaud.
1094. Thomas Harris.
1098. W. H. D. Granville.
1102. C. R. Barnes.
1103. C. B. Normand.
1107. J. C. Martin.
1109. William Thomson.
1112. John Underwood.
1114. W. E. Newton.
1122. Edwin Marten.
1126. James Sharples.
1128. T. Burton and S. Lord.

1134. R. Taylor, R. Worswick, and J. Lovatt.
1135. Gerolamo Cavanna.
1137. C E. Osmont.
1138. William Robertson.
1141. George Welch.
1143. Matthew Dunnet.
1145. David Milnes.
1146. G. Scarr and J. Pollard.
1148. John Garnett.
1149. Jaques Richard.
1151. George Wright.
1152. A. D. Bishop.
1153. W. C. Cambridge.
1155. A. P. Rochette.
1157. A. P. Rochette.
1159. Edward Manico.
1160. William Clark.
1162. Thomas Craddock.
1163. J. Caddick, T. Hemmings, and D. Caddick.
1167. S. Sunderland, and R. Deans.
1168. E. W. Otway.
1170. Thomas Mann.
1171. J. Simpson and E. Rimmer.
1176. W. Pickstone.
1180. Charles Cowper.
1186. Alfred Eddington.
1187. T. D. Rotch.
1188. William Levesley.
1189. Julien Billiard.
1200. D. Chadwick and A. H. Frost.
1202. Charles Pascall.
1208. J. Bottomley, C. Hodson, and W. Fielden.
1211. Frederick Walton.
1212. Frederick Walton.
1214. L. H. Spooner.
1215. Barnard Barcroft.
1216. Thomas Baldwin.
1220. Charles Cammell.
1226. James Anderson.
1231. J. H. Johnson.
1235. Edward Tucker.
1242. J. S. Greenhow.
1249. T. J. Cooke.
1252. John Stanley.
1264. Juste Herrero.
1266. R. W. Sievier.
1279. Arthur Kinder.
1283. W. E. Newton.
1290. Richard Bennett.
1296. William Smith.
1300. W. C. Cambridge.
1304. Theodore Lipkau.
1305. J. W. Schlesinger.
1311. W. P. Miles.
1317. Robert Wilson.
1321. John Miller.
1322. John Miller.
1330. P. A. Le Comte de Fontainemoreau.
1337. T. Lambert and O. Wakefield.
1354. Michael Henry.
1361. W. and J. Hyde.
1409. J. W. Burton and G. Pye.
1420. L. Lethuillier.
1428. E. C. Kemp.
1438. J. W. Hackworth.
1440. Meyer Drukker.
1470. John Crossley.
1511. W. E. Newton.
1512. A. V. Newton.
1522. P. A. Le Comte de Fontainemoreau.
1542 L. L. Bequemie.
1565. George Deeley.
1611. P. A. Le Comte de Fontainemoreau.
1615. W. E. Newton.
1669. J. H. Johnson.
1682. J. Fowler and W. Worby.
1684. J. Fowler, R. Burton, & T. Clarke.
1686. Joseph Ellis.
1694. J. H. Whitehead.
1723. E. V. Gardner.
1749. R. Shaw and J. Robinson.
1772. J. H. Johnson.
1802. S. Gaudrion.
1841. M. A. Laurent.
1878. R. J. Badge.
1882. P. A. Le Comte de Fontainemoreau.
1909. J. S. Russell.
1915. William Johnson.
1924. W. E. Newton.
1927. W. Woodman.
1930. J. Chanter and D. Annan.
1934. J. Loach, J. S. Salt, and B. Day.
1945. J. H Whitehead.
1949. W. E. Newton.
1953. F. C. Calvert and C. Lowe.
1955. James Webster.
1966. Edmond Bertin.
1968. G. Walker and J. Clachan.
1983. T. F. Griffiths.
1993. W. E. Newton.
2002. W. E. Newton.
2007. Samuel Butler.
2012. W. E. Newton.
2015. James Hall.
2023. J. J. Bouvert and F. J. J. Pascal.
2059. J. Dortet and A. B. Denis.
2062. John Clay.
2075. W. Mc Kinley and R. Walker.
2077. John Frearson.
2097. Thomas Rickett.
2126. Thomas Lawley.
2131. A. V. Newton.
2133. W. I. Holdsworth.
2168. Frederick Lipscombe.
2229. G. and W. Steell.

**** For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S
London Journal of Arts and Sciences.

NEW SERIES.—No. XXXVI.

OUR SYSTEM OF CURRENCY, WITH SUGGESTIONS FOR ITS AMENDMENT.

THE monitary pressure under which the mercantile classes of this country are now suffering, has once again brought into prominent notice our system of currency; and from the many able articles which have appeared in the leading daily and weekly journals, and the discussion which must arise on the assembling of Parliament in the present month, we may hope to see a more general and intelligent appreciation of the subject than it has ever yet received. The small fraction of the community, to whom the currency question has hitherto presented any features of interest, has been content, either to denounce the return to cash payments as a dishonest attempt to depreciate all manufactured products, for the advantage of capitalists, or to extol the Bank Charter Act of 1844, as essential to the existence of sound commercial prosperity. It is not our intention, in the remarks which we propose to make on this most important subject, wholly to condemn the much lauded Act, although it has proved unequal to the ever extending wants of this great commercial country, and is now virtually defunct, by reason of the permission accorded by the Government to the Bank Directors for its infraction; because we cannot but acknowledge that it has been mainly instrumental in putting British commerce on the healthy footing which it at present holds. Neither do we desire to support the Act as a final and satisfactory measure, for the system which it enforces lacks that one vital element—expansion, without which, no system of currency can sustain itself in periods of pressure like the present. But, defective as is the monitary system which now rules the destinies of our manufacturing and merchant princes, it is, in our opinion, infinitely preferable to those loose practices which gave place to the stringent and precautionary measures of the late Sir Robert Peel, and a return to which the good sense of the country will render impossible. Whatever else the Government may be induced to carry in the coming session, we have certainly seen the last of an unlimited issue of bank notes, representing nothing but the neediness or imprudence of the bankers who issued them.

The difficulties which present themselves to the investigator of the currency question, and thereby prevent him from arriving at a satis-

factory conclusion on the subject, arise chiefly from the fact, that he comes to the consideration of the debatable points, either in the spirit of a banker, whose business is to lend money, or of a merchant, whose practice is to borrow it; but as these two interests have the same relation to each other, as buyer and seller, it is impossible, siding with either of these, to arrive at reliable conclusions. The question must be viewed from a higher elevation, and studied in a thoroughly philosophical spirit, before the cloud of mystery which hangs over it, created by jangling of discordant interests, can be pierced by the mind's eye, and the broad features of the subject brought into one focus.

If we were to imagine a combination of circumstances the most favorable for rendering a mixed currency of convertible paper and gold equal to the wants of a nation, we should say, the people to use it must be industrious and enterprising, eminently skilful in the manufacturing arts, and capable of producing unlimited quantities of goods, applicable to all climates, so as to ensure a wide-spread trade with foreign countries; prudent withall, and possessed of colonies capable of yielding an unlimited supply of gold. Had England been so conditioned when the Bank Charter was passed, there would have been few, even among its staunchest opponents, who would in their hearts have doubted of its entire success. But, though we have sketched a picture, the realization of which no sane man could have dreamed of in the year 1844, yet these accumulated advantages, which the nation now possesses, have failed, when coupled with our currency system, to secure to us the uninterrupted prosperity so essential to the well-being of the community, and which, from the late bountiful harvest, we were warranted, for the present time at least, in expecting to enjoy.

Before, however, laying the present commercial distress upon the currency laws, we should assure ourselves that we have reason for so doing. Let us therefore trace its operation, and condemn, if we must condemn, understandingly, that system which we have admitted is not without its merits. In the *Times* newspaper, the avowed and eloquent advocate for the present law, we are told that, when the Act was established, the total circulation of notes was £36,000,000; but as no provision was made for the expansion of the circulating medium, concurrent with the increase of trade, except through the accumulation of gold in the cellars of the banks of issue, it followed that, wanting this, the time must soon arrive when, by the natural law of progress, trade would be crippled for lack of the mere mechanical facilities of exchange. Besides this difficulty, which to get over would require a continuous increase in the production of gold, equal to the ever increasing wants of commerce (which until the discovery of the philosopher's stone, will be practically impossible), it must be remem-

bered that this mass of notes, representing £36,000,000 sterling, is, by a fiction of law, convertible into gold at any moment; while at no period has it been, or can it be, within the power of the banks of issue to effect this transmutation: as soon, therefore, as the sign of an approaching storm is discernible on the commercial horizon, the banks, when prudently managed, contract their issue of notes, and increase their stock of bullion, in order to prepare for possible contingencies. This policy necessarily causes a diminution in the circulating medium most embarassing to trade and commerce, and thereby hastens the crisis against which it is intended to provide. As, also, in monitary affairs, no country can suffer alone, because, by the ties of commerce, all civilized nations are indissolubly knit together, like the several members of the human frame, a convulsion in one will be felt in all, though not, perhaps, with the same intensity. When, therefore, a monitary crisis occurs, gold is simultaneously in demand in all quarters, for one and the same reason, and thus we come eventually, as in the year 1847, to a dead lock in commercial transactions. It is, however, true, that the disastrous result of such a state of things, hanging, as it does, *in terrorem* over the heads of too sanguine speculators, has the effect of checking many visionary projects in the bud, but it unfortunately does more than this, and hence the necessity which Government has seen, at two different periods, for lightening the pressure, upon the mercantile community, of the Act of 1844, before the setting in of a panic. Now, the merits which the advocates for this law claim for it are—first, that a check is provided against unhealthy speculation; and, secondly, that depreciation in the value of the paper currency is effectually provided against; but then, as a set-off against these manifest advantages, is the no less important defect of a limited, or rather gradually contracting, supply of notes, when the expansion of the paper currency is most needed.

A careful scrutiny of the provisions and working of the currency laws will afford us the means of judging whether they are really based upon true financial principles, or not. The policy of Sir R. Peel, throughout his whole career, was undoubtedly to deprive private banks of the power of issuing notes, and to concentrate that privilege in a Government establishment. This he in part effected, but never found himself strong enough to accomplish entirely. Thus we find English banks of issue limited in their supply of notes to the amount of specie in their coffers; while the Scotch banks are permitted to put out notes representing no less than £3,087,239 over and beyond the amount of specie which they hold. Again, the Bank of England, which is at once both a public and a private establishment, may issue notes to the extent of £14,000,000, representing nothing of tangible property; and beyond this, notes to any

amount not exceeding the specie held by the bank. Here then we see a palpable inconsistency in the law; the most vital point in the system being that all notes in circulation shall be the representatives of gold, and convertible at any moment into cash; while the only means for ensuring this conversion is intentionally set aside; yet because the notes now in circulation possess the magical words; "I promise to pay," which promise it would be simply impossible to redeem, if the public were to demand payment, the promoters of a non-convertible paper issue are requested to consider themselves annihilated by the following burst of enthusiasm in the *Times* of November 17th,—"Unless any one can be found to contend, that a person who has contracted to deliver one thing may be allowed to substitute another, all mankind will admit we had thus attained a perfect system." Let us now see, by a reference to figures, how this perfect system works, premising that commercial transactions, when extending over all parts of the world, cannot be contracted in a moment at the first whisper of danger, although no little assistance is now rendered in transmitting communications by the expediting powers of steam and electricity. Not to burden our pages with figures, we will content ourselves with tracing the progress of the crisis by reference to the returns of the Bank of England for one month previous to the suspension of the Act, by order of Government, and we will then examine, as far as the published returns will permit us, the action of the country banks of issue, and the Scotch banks. In the week ending October 10th, we find the specie in the Bank coffers amounted to £9,539,510, and the notes then issued represented £24,014,510. As the demand for gold for export increased, this nine millions and a half, in one month, notwithstanding the rapid rise made in the meanwhile in the rates of discount, dwindled away, until in the week ending November 11th, it was reduced to £6,666,065, at which time the notes in circulation had been contracted to £21,141,065, representing a reduction in the circulating medium of £2,873,445. At the same time, viz., in the week ending October 10th, the country banks of issue had in circulation notes representing £6,842,292, and by the 14th November, they had reduced their issue to £6,565,808, making a further reduction of nearly £300,000 in the circulation of the country. Thus we find, that in the month preceding the suspension of the Act, the circulation of notes in England, notwithstanding there had been a previous contraction of the issue,* was reduced to the extent of upwards of three millions of pounds. This, we are told, is the peculiar merit of the present system, because it puts the curb upon trade, and

* The return of the Bank of England, for the week ending September 12, shews the amount of notes in circulation to have been £25,067,200, or little short of four millions more than on the corresponding week in November.

keeps it within due bounds. But if it be a merit, it should be one that all parts of the Kingdom should participate in: thus, for example, Scotland should not be deprived of the benefits accruing from the contracting principle. Unfortunately we are not enabled to trace the action of the Scotch banks up to the same period as the English banks, but perhaps a comparison of the returns for the last three months will afford a correct notion of their mode of proceeding. We have said that they are permitted to issue, in the aggregate, uncovered notes amounting to upwards of three millions of pounds sterling; from prudential motives, however, it seems that uncovered notes to this extent have not of late been in circulation. Thus, the average weekly circulation during the month ending August 29th, was £3,932,997, of which £1,567,011 of notes was covered by gold in hand. In consequence, it might be, of the ordinary fluctuations in trade, the next return, dated September 26th, shewed notes in circulation amounting to £4,051,239; the banks holding, at the same time, £1,573,546 in specie. As the pressure in the money market increased, we might well suppose that notes were being withdrawn from circulation, as in England; but not so:—our shrewd northmen, finding money in greater demand, and discounts proportionately rising, began to realize, and increase the amount of gold in their coffers, with the view of putting it to more profitable account. By the last published return, we perceive the gold held by the Scotch banks had increased to £1,675,785, and on the strength of this increase, amounting in round numbers to £100,000, they issued additional notes to the value of £200,000, thus reversing the course of action imposed on the Bank of England by its Charter. Which of these courses was right and proper under the circumstances, or whether they were both unexceptionable, remains for the advocates of the present system to determine. To us it presents evidence of imperfection; we cannot therefore admit, with the *Times*, that the country has yet attained a perfect system.

Now, whatever be the nature of a currency which a country may be content with in its internal dealings, it is quite certain that gold must be employed in its foreign transactions. If, therefore, a nation were to adopt an inconvertible paper currency, it must be used together with gold, and also be interchangeable with it, or inextricable confusion would ensue. But if paper money is made inconvertible, the privilege to manufacture it must necessarily be vested in the State, and means must be taken, somewhat stronger than a Parliamentary enactment, to prevent a depreciation in its value: without this, paper currency is a fiction, or, like the assignats of the French Republic, an imposture. This result, we think, can only be ensured, 1st,—by making the notes issued represent tangible property; 2nd,—by restricting their issue to

the wants or demand of the public; and, 3rd, by ensuring their gradual withdrawal from circulation, in proportion as gold accumulates in the country. If these three points were secured, inconvertible notes might, we think, be issued in unrestricted quantity, with the certainty of their maintaining their full value. It will, however, be asked,—How is this to be effected? We will now attempt a solution of this question, keep-in mind the wise policy that dictated Sir R. Peel's enactments, also the general belief in the omnipotence of gold, and the existing state of the banking machinery of the country.

As gold is the only medium of currency common to all nations, it follows that that must still remain the basis for any paper currency for home use, or paper and gold cannot, as they should, be interchangeable. Thus, whatever our notes of issue may be termed, they must bear upon their face a mark signifying the value in gold which they represent; and to give them currency, they must of course be deemed a legal tender. So far the paper money which we propose to create will be precisely like the notes of the Bank of England; but as the latter are really bills of exchange, payable at sight, and consequently liable to be returned upon the Bank at any moment, our notes would differ from them, first, by representing other property than gold, on the security of which they were issued, and, secondly, by being legally inconvertible, so long as they remained in circulation. These notes should be issued by a department of the Government, and on the application of parties requiring advances upon readily convertible property, as loans, bearing interest at the market value of money. In order to ensure the proper working of this system of currency, it would be requisite, or at least politic, to abrogate the privilege enjoyed by certain banks, of issuing notes, and to confine that right to the Bank of England, which establishment should issue them only on a metallic basis. Some privileges should be preserved to the Bank, to enable it to retain the important position which it now holds, in relation to commercial transactions, for the purpose of affording, as it does at present, a true indication of the state of the money market, and the value of specie. As the rates of discount vary at the Bank, so should the interest chargeable on the loan notes be determined. The effect of this course would be to favor the return of the loan notes to the department whence they were issued, as soon as an influx of gold into the country operated to bring down the rates of discount, and enabled the borrower to provide himself with money at a lower rate of interest. If, on the other hand, by any sudden convulsion abroad, as that under which the country is now suffering, the gold were temporarily withdrawn in great quantities, there would be a reliable currency to fall back upon, unlimited in quantity, but rising in value, according to the market value

of specie, and thereby offering no obstacle for the return of gold to the country. This project, we conceive, is essentially distinct from the employment of notes issued by a bankrupt Government (like some of the continental States), to enable it to continue a little longer its course of wasteful expenditure; and also of notes issued by private bankers, determined at any hazard to drive an extended trade. The means, in fact, of bankers so inclined to speculate on probabilities would be greatly curtailed, as all paper money would then have a real, in contradistinction to a fictitious value, which much of it now possesses. As an example of the operation of the system, let us suppose a loan to have been effected for £10,000, upon some readily convertible property, say railway shares, deposited with the issue department; and the interest due upon this sum to have accumulated to a determinate amount, beyond which it was thought undesirable to allow it to increase: the borrower, after due notice given, failing to redeem his property, it would be sold at the market price, and the balance carried to his credit. No loss would therefore accrue to the department, a proper margin having been left, at the time of contracting the loan, between the market value of the property and the amount of the notes advanced. An advantage, consequent on the use of this kind of paper money, would be, that a disposition would no longer exist on the part of bankers and traders to hoard gold: as to the former, its possession would give no peculiar advantage, while to the latter class, its free circulation, by keeping down the rate of discounts, would present a manifest advantage. Another advantage would be, that there would then be the possibility at least, if not the desire, to carry on business by cash transactions; and it is not too much to expect that the practice of giving and requiring such large credits as are now necessary, would give place to a healthier, because safer, practice. It may be urged that this plan, by crippling the lending powers of the present banks of issue, would render money permanently dearer: this it undoubtedly would do, but the sums paid for interest on loans would, from shortening credits and otherwise facilitating the payment of accounts, represent merely a premium of insurance against losses from bad debts. A large profit would necessarily accrue to the department issuing the notes; sufficient not only to pay ample compensation to the banks whose privilege of issuing paper would be withdrawn, but also to form a very acceptable item in the Treasury account.

To the metallic currency advocates this will appear, no doubt, a very wild project, shallow as it is presumptuous: it remains, however, to be seen whether they can propound a better. With respect to the present "perfect system," this much is certain—that it has been tried for thirteen years, and has twice failed,—that is, failed so far that the public

would not endure its severity. A change, and that immediately, must therefore be made; and now, if ever, it is the duty of individuals to offer their aid. This is our plan: let others, more able to cope with the subject, and having the same earnestness of purpose, present theirs, and doubtless from among the offerings there will be found useful hints, whereby an industrious and wealthy nation, in the peaceful enjoyment of a bounteous harvest, may be saved from the disastrous consequences of a suddenly disorganized currency. If this be done, it is all we desire, but let us not, with the currency writers of the *Times*, countenance for a moment the retention of the Bank Charter Act in its integrity, which presumes that gold may be retained in such quantity in the country, under all circumstances, as to meet the legitimate wants of the community; and that for its departure our merchants and manufacturers are answerable, and must pay the penalty.

RECENT PATENTS.

To JOHN COOPE HADDAN, *of Cannon-row, Westminster, for improvements in smelting ores, and in roasting and extracting products therefrom,—being a communication.*—[Dated 14th January, 1857.]

THIS invention consists, firstly, in creating the current of air necessary to the reduction of the ores in a furnace, by exhausting or removing the air and gases as produced; the exhaust being effected by means of a fan or otherwise. Secondly, in roasting or partially roasting ores by means of the heated air and gases, one or some of them, thus collected, passing off from furnaces; and also the employment of the heated air and gases to the smelting process, or otherwise to the extraction of products from the ores. Thirdly, in constructing furnaces, and more particularly those intended for smelting the ores of iron, with the interior passage or chamber of the furnace lying at an inclination or angle, and with hoppers or feeding places communicating therewith at different parts, so as to afford the means of making special additions to particular portions of the contents, and so as to assist in reduction, or to give a different character to the metal; perforations being made in different positions, for inspecting the progress, for tapping the furnace, and for ingress of air.

In Plate XII., fig. 1, is a sectional elevation of an improved furnace for smelting the ores of iron, constructed in accordance with this invention; and fig. 2, is a sectional plan view taken just above the hearth of the furnace. *a*, represents the interior passage or chamber of the furnace; *b*, an opening in the dome or upper portion, to receive the ore &c.; *c*, a hopper or receptacle in which the ore, &c., is first put; *d*, a sliding stop-plate, which supports the ore, &c., until the receptacle *c*, is filled, and which is withdrawn when the ore, &c., is to be let into the body of the furnace; *e*, a cover at the top, which is opened, when desired, by the chain and weight 7; 6, is a portion of the domed cover of the furnace; and *i*, a pipe attached

thereto, which unites with the pipe of the exhausting apparatus. This apparatus, which is simply an ordinary fan, is boxed or closed in, so as to draw the air only from the inside of the furnace, and is worked or driven by a band. The dome top of the furnace is double. The upper cover 8, is pierced with holes, so that should it be desirable to send heated air into the lower part of the furnace, this object may be attained by allowing the air for supplying the furnace to pass down the pipe 5, and enter into the lower part at *t**, fig. 2; it will then pass into the circular passage *s*, *s*, *s*, and may be admitted, as desired, to cause a reduction of the ores, in the direction of the arrows; the doors or partitions *s**, *s**, *s**, *s**, being opened or closed, according to the wish of the workman, to direct a heated or cold current, as may be desired, one in one place and another in another, or all cold or all warm. The heated current is obtained by the air becoming warm in passing through the holes in the upper dome 8, and coming into contact with the covered dome 6. *k*, *k*, *k*, are the receptacles, hoppers, or feeding places, before alluded to, for introducing special additions of any material that may be desired to or near to particular portions of the contents; and these feeding places may, if it should be preferred, be furnished with sliding stop-plates, as above described with reference to the hopper *c*. *l*, *l*, *l*, are pulleys and chains, with weights 7, 7, 7, attached, for raising the covers of the feeding plates *k*, *k*, *k*. *m*, *m*, *m*, represent the perforations or holes for inspecting the progress of the operations of the furnace, and for procuring samples therefrom, and for the ingress of air or gases as may be desired, and they may be also employed for allowing the workmen to stir or move about the materials inside the furnace with a rod, Plugs or stoppers are adapted to each hole *m*, for closing or opening them at pleasure, but two only of such plugs, marked *u*, *u*, are represented. *o*, is the receptacle for the melted metal; *p*, the lining of the furnace; *q*, the boshes; *t*, is simply an archway for lightening the brickwork; *v*, is the floor of the furnace; *w*, air holes, to prevent the damp from injuring the furnace; and *y*, *y*, *y*, are recesses for the same purpose.

Fig. 3, represents an improved method of creating the exhaust, which is applicable also to blowing the ordinary blast furnace. When employed for blowing, it is to be used as represented; but when employed for exhausting, then the drum or head *g*, which moves round, must be inclosed, and a pipe from the inclosure must be attached to the pipe *i*, fig. 1, on the dome cover, so that the air may be exhausted, and pass out at *i*, fig. 4. In this figure, *g**, is a tube in continuation of, and from one side of, the drum *g*, and revolving therewith,—the opposite side of the drum being closed. *k*, is a stationary tube in further continuation; and *b*, a collar connecting the tubes *g**, and *k*. *c*, *c*, is a shaft on and with which the drum *g*, and tube *g**, revolve,—one end being supported in the bearing or standard *d*, and the other on an upright bearing over and in continuation of the standard *d**, and within the tube *k*. *e*, is a pulley for driving the apparatus, which may be effected by means of steam power or otherwise; *h*, *h*, are two projecting pieces, of which there are four or more round the drum, each being of the form represented; they are closed at each side, but open underneath, and a slit or long hole is cut in the sheet metal of which the drum is made, so as to make a communication with the inside of the drum. It is evident that if the drum moves rapidly, the air must be collected by the projecting pieces *h*, *h*, and conveyed into the interior of the drum, and as it has no means of escape while the drum revolves,

but at the end *i*, in the direction of the arrow, the apparatus will blow, if constructed as represented, and will exhaust, provided the revolving drum is inclosed, and a pipe from the box or case inclosing the drum communicates with the pipe *i*, on the dome (see fig. 1).

The roasting or partially roasting of the ore will be effected by the first action of the furnace upon it, immediately upon and after its discharge into the furnace from the hopper or receptacle *c*, on withdrawing the stop-plate *d*; or the heated air and gases exhausted or drawn off from the furnace may be conveyed to any convenient place, for the above or any other useful purpose, or may be discharged by a chimney shaft, which, if very high, may be used instead of a blowing or exhausting apparatus, as above set forth and described.

To JAMES WARNE, *of Weymouth-place, New Kent-road, for a new combination of metals applicable to decorative and useful purposes, part of which invention is applicable also to the method of combining metals and alloys of metals,*—[Dated 22nd January, 1857.]

THE first part of this invention consists in forming a new combination of metals applicable to covering the tops of bar or shop counters, tables, &c., by soldering or fusing together the following metals or alloys of metals, so as to produce a hard metallic surface resembling silver, inseparably combined with a body or back of baser metal. The alloy employed for the surface consists of the following metals, namely, block or ingot tin, nickel, bismuth, and cobalt. The proportions of these metals may be varied, according to the nature of the application, but for covering the tops of bar or shop counters, the following proportions are preferred, namely, to one hundredweight of block or ingot tin, seven pounds weight of nickel, seven pounds weight of bismuth, and three pounds weight of cobalt. The alloy employed for the body or back consists of common pewter or lead, hardened with regulus or spelter to the same degree as the surface metal or alloy.

The second part of the invention consists in a novel method of soldering or uniting by fusion the above alloys of metals. The first metal or alloy, in a liquid or fused state, is to be poured into a vessel or mould to the required depth, and when just set, a heated perforated metal plate is placed upon the surface, to fuse the same. As soon as the metal or alloy rises through the perforations, the plate is withdrawn, and the second metal or alloy is poured in. Thus a block or ingot is produced, formed of two distinct metals or alloys, firmly and inseparably combined or soldered, which may then be rolled out into sheets of the required thickness; and the two metals or alloys both being of the same hardness, will spread or draw evenly, and their relative proportions will always remain the same, however thin the plate may be rolled out. The above combination of metals or alloys of metals is peculiarly applicable for stills and other apparatus used in distillation, and is equally applicable to almost any useful or decorative purpose where it is desirable to have a fine or costly metal or alloy of metals, or the surface backed up to the required strength or thickness with a baser metal or alloy of metals.

The patentee claims, Firstly,—forming a combination of metals applicable to decorative and useful purposes, by soldering or fusing together

ingots of fine and base metals, or alloys of metals, as above described,—such base metal or alloy being hardened to the same degree of ductility as the finer or surface metal or alloy. And, Secondly,—the method of fusing or soldering together ingots of metals or alloys of metals, as above described.

To HENRY MEDLOCK, *of Great Marlborough-street, for an improved method of purifying water.*—[Dated 21st January, 1857.]

THIS invention consists of a method of purifying and rendering more wholesome and useful water which either contains in solution only organic matter or the products of its decomposition, or which may also contain in solution inorganic matter, by separating and removing from the water a portion of such organic matter, and rendering the remainder of such organic matter innocuous; and in case the water also contains in solution inorganic matter, by separating and removing from the water a certain portion of such inorganic matter, and by rendering innocuous any phosphides or sulphides which the water may contain in solution, by converting such phosphides into phosphites or phosphates, and such sulphides into sulphites or sulphates respectively.

The water, previously to its filtration, is placed in a vessel or reservoir of convenient size, and there allowed to remain, in contact with certain solid bodies of metal or other substance presenting a sufficient extent of surface to the water, for twenty-four hours or longer, according to the quantity of water as compared with the exposed surface, or until the precipitation of organic matter, occasioned by such contact, ceases, after which, any of the precipitate occasioned by the aforesaid process, which may remain suspended in the water, should be removed by filtration in the ordinary manner.

The solid body preferred to be used is iron (on account of the little injury the water sustains by contact therewith), and in the form of scrap-iron, iron turnings, iron wire, or sheet-iron.

The following is the mode of applying the invention:—Suspend in a tank or reservoir containing the water to be purified, by means of iron rods passing across it, iron wire of about one-sixteenth of an inch in diameter, loosely packed in bundles or coils, and in the proportion of about one pound weight of such wire to every one hundred gallons of water. Allow the water to remain in contact with the iron wire from twenty-four to forty-eight hours, according to the rapidity with which the precipitation of organic matter, occasioned by such contact, takes place; and then pass the water through any kind of filtering medium now in use, which is capable of retaining the precipitate formed. For the filtration of water in large bulk, the ordinary sand filter may be used. The effect of the contact of the water with the solid bodies above described, when the water contains nitrogen in any form, is to decompose or oxidise the organic matter, and the ammonia contained in the water; whereby a certain part of the organic matter, and ammonia, is converted into nitrous or nitric acids, or both of them, by which the rest of the organic matter is rendered insoluble. The nitrous and nitric acids finally combine with the iron or other solid bodies above described, or with some of the inorganic bases, if any, contained in the water; and the organic matter rendered in-

soluble is precipitated, together with some part of the inorganic matter, if any, contained in the water; and any phosphides or sulphides which may be contained in the water are converted by oxidation into phosphites or phosphates, or sulphites or sulphates, respectively, which are comparatively harmless.

To SAMUEL JABEZ GOODE, *of Aston, near Birmingham, for an improvement or improvements in depositing metallic alloys by electricity.*— [Dated 31st of March, 1857.]

ACCORDING to the ordinary method of depositing metallic alloys by electricity, a solution of the alloy is made, and the surface on which the alloy is to be deposited is suspended in the solution, together with a plate of the alloy itself. The surface on which the alloy is to be deposited is connected with the zinc end of a voltaic battery, and the plate of alloy is connected with the copper or negative element of the said voltaic battery. The passage of the electricity through the solution causes the deposition of the alloy on the articles connected with the zinc, and also causes the alloy to dissolve from the plate of alloy. In this method the following difficulties present themselves, namely,—a change in the temperature of the solution, or in the quantity or intensity of the electrical current, as well as various other causes, occasion a change in the relative quantities of the metals deposited, and thus affect the composition and qualities of the deposited alloy. For example,—in the deposition of brass, by the ordinary method, the relative quantities of copper and zinc in the deposit vary, from slight changes of temperature and other interfering causes; and it is difficult to secure the requisite uniformity in the composition and color of the deposited alloy. By the present invention these difficulties are obviated, and perfect control over the composition of the deposited alloy is secured.

The invention consists in using plates of the metals of which the alloy is composed, instead of a plate of the alloy itself in the solution from which the alloy is being deposited. For example,—in depositing brass, instead of suspending in the solution a plate of brass, and connecting the plate with the copper or negative element of the battery, two separate plates, one of copper, and the other of zinc, are used, and connected with the copper or negative end of the battery. By immersing one or other of these plates to a greater or less depth in the solution, or by bringing one or other of the plates nearer to the surface on which the alloy is being deposited, the composition and color of the deposited alloy can be regulated at pleasure. For example,—if, during the deposition, the brass is found to be too light in color, the plate of copper is immersed to a greater depth in the solution, or brought nearer to the surface on which the brass is being reduced or deposited; or the zinc plate is in part withdrawn from the solution, or removed to a greater distance from the surface on which the brass is being reduced or deposited. By either of these means the relative quantity of copper dissolved from the copper plate, and deposited in the alloy, is increased, and the color of the deposited brass deepened. The opposite effect is produced by the inverse mode of operating.

The patentee claims, "the improvement or improvements in depositing metallic alloys by electricity, hereinbefore described, that is to say, con-

necting with the copper or other negative element of the voltaic battery (or its equivalent in any other source of electricity) used for depositing metallic alloys, separate plates of the metals composing the alloy to be deposited, instead of a plate of the alloy itself, so as to control the composition of the solution from which the alloy is being deposited, as herein described."

To William Gregory, *of Old Church-street, Paddington, for an improvement in the construction of roofing tiles.*—[Dated 5th May, 1856.]

The object of this invention is to form roofing tiles in such a manner that, when applied to a roof, they will effectually prevent the ingress of water and damp at the junctions, and will require no mortar to secure them in position. The tiles are provided with a rib at one edge, and an arched lapping piece at the other; but in order to effect a complete, in contradistinction to a partial, lap, at right angles to these, or in a line parallel with the ridge of the roof, the arched lapping piece of each tile (except the eave tiles) is formed in a recess or cup, to receive the ends of the arched lip of the adjoining tile. This recess or cup is made of a depth equal to the width of lap required for two adjoining rows, and the workman or tiler is thus provided with a gauge for fitting the tiles together. The tiles being provided with knobs on their under side, may be simply hung upon the laths, as usual, or they may be secured by nails. Recesses are also formed at the opposite edges of the ridge tiles, so that they will completely overlap the upper edge of the top row of tiles at the opposite sides of the ridge, and thereby produce a good water-tight joint, which may, when thought desirable, be further secured by a thin line of mortar or cement. The tiles may not only be made of clay, as usual, but they may also be formed of glass, earthenware, pot stone composition, wood, gutta-percha, metal (such as iron, zinc, tin, or lead), or other suitable material.

In Plate XII., fig. 1, is an edge view or section of part of a roof formed of the improved tiles; and fig. 2, is a cross section of the same. *a, a,* is the body of the tile; *b, b,* the rib or ridge at one edge, and which is cut away at one end, so as to allow the next tile to fit down close; *c, c,* is an arched lapping piece at the other side of the tile, which fits over the rib or ridge *b, b,* of the adjoining tile; *e,* is an enlargement or cup on the lower end of the arched lapping, and provided on the inner side with a recess, to receive the upper end of the adjoining tile, on which it fits closely, as shewn. The form of the ridge tile will be seen on referring to fig. 2. *f, f,* is the round hollow ridge, or top of the tile; *a, a,* the body thereof; and *e, e,* the cups, sockets, or recesses, for receiving the upper ends of the arched lapping pieces *c, c,* of the first row of tiles.

The patentee claims, "constructing roofing tiles with a rib or fillet on one side, to stand up above the face of the tile, and an arched lapping piece on the other side or edge of the tile, with a groove therein to fit the fillet or rib of the adjoining tile."

To Alfred Vincent Newton, *of the Office for Patents, Chancery-lane, for improved machinery for cultivating land,—being a communication.*— [Dated 8th April, 1857.]

This invention relates to the cultivation of land by spades, operated by locomotive power as the machine progresses in the field; the machine will also more thoroughly break up, disintegrate, and turn over the sward than can be done by ploughs. The entire machine is propelled in the field, in any direction required, and turned at the will of the attendant; and the same power which does this, operates a series of spades, which enter the land, each in succession, and cut into it in the arc of a circle, and, after cutting down to the required depth, suddenly throw up the cut slice against a shield plate, so as to reverse it, and at the same time to break it up, so that, when it falls down, it will be thoroughly disintegrated; the forward movement of the machine determining the thickness of the slices to be cut by the spades.

In Plate XI., fig. 1, is a side elevation of the machine; and fig. 2, a longitudinal vertical section. *a*, represents a frame adapted to the purpose; and *b*, *b*, two running or sustaining wheels, which turn freely on an axle *c*, in the rear part of the frame. The axle *c*, extends through, and is so mounted in, the frame, that it may be rotated by a crank handle *d*, at one end; and the said axle carries on each end a cam *e*, for the purpose of elevating the spades above the surface of the land, when the machine is required to be moved from place to place, and to regulate the depth to which the spades shall cut. The forward end of the machine is sustained on a broad driving-wheel *f*, the face of which is provided with spurs, to take hold of the land, so as to draw the machine forward at the required speed. This wheel is secured firmly to its shaft *g*, which has its bearings in a horizontal ring *h*, fitted to turn in another ring *i*, of the frame, so that the ring *h*, may be turned, to put the plane of the driving-wheel at any desired angle, to determine the line of motion of the machine. The ring *h*, has a flanch above and below, to embrace the ring *i*, of the frame, the latter of which flanches is secured to the under part of the ring *h*; and the upper flanch is provided with a handle *j*, by which it can be turned when it is desired to change the line of direction of the machine; but if desired, this flanch may be cogged, so as to admit of turning the ring by a pinion with a crank handle; or the ring can be turned in any other suitable manner. The middle of the thickness of the driving-wheel is in the plane of the axis of the ring *h*, and on one face of this wheel there is a bevil cog-wheel *k*, which is engaged by a pinion *l*, on a vertical shaft *m*, (shewn by dotted lines in fig. 1,) mounted in a bracket piece *n*, attached to the ring *h*, so as to turn therewith; and on the upper end of the shaft *m*, there is a cog-wheel *o*, deriving motion from a pinion *p*, (see fig. 2,) on another vertical shaft *q*, mounted in the main frame, and having its axis in the line of the axis of the ring *h*, so that the cog-wheel *o*, will always be in gear with the pinion *p*, however the ring *h*, may be turned to guide the machine. The shaft *q*, derives motion by a bevil-wheel and pinion *r*, *s*, from a horizontal shaft *t*, mounted in the main frame, and this shaft in turn receives motion by a belt *u*, from the main driving-shaft *v*, which is provided with two cranks at right angles, and operated by two oscillating steam-engines *w*, *w*, mounted between the standards *x*, *x*, *x*, of

the frame, which are hollow, to form steam exhaust-pipes, the steam being supplied to the steam-pipes from the boiler *y*, in any suitable manner.

From the foregoing it will be seen that, when the main shaft is rotated, motion will be imparted to the driving-wheel by the train of wheels above described. The motion of the driving-wheel must be such, that it will impel the machine at a velocity suited to the action of the spades, to be presently described, and so that they will cut the required thickness of slice.

On the main driving-shaft *v*, there is a spur-wheel *z*, which engages a corresponding spur-wheel a^1, on a cam b^1, which shaft is parallel with the main driving-shaft, and all the motions for operating the spades are derived from cams and excentrics on this shaft.

An auxiliary frame c^1, composed of two side and one end pieces at the rear end, sustains the spades and their appendages; and the forward end of the side pieces of this frame are hung on the ends of the cam-shaft b^1; where the ends project outside of the main frame, so that this auxiliary frame can vibrate on the cam-shaft as an axis, the side pieces being provided with projecting pins d^1, which rest on the periphery of the cams *e*, *e*, on the ends of the axle *c*, of the running-wheels *b*, *b*, before described; so that, by turning this axle with its cams, the rear end of the auxiliary frame c^1, with the spades, can be elevated or depressed at pleasure, either to determine the depth to which the spades shall cut, or to make them clear the surface of the land, when moving the machine to any place desired.

At the rear end of the auxiliary frame c^1, there is a rod f^1, which passes through the eye of, and forms an axle for, a series of vibrating arms g^1, equal to the required number of spades, which, in this instance, are five. These arms g^1, are connected by joint links g^2, with the rear end of a corresponding series of levers h^1, which vibrate on a fulcrum-rod i^1, attached to the standards j^1, j^1, on the sides of the auxiliary frame c^1. Each of the levers h^1, is provided with a spring-bar k^1, attached at the rear end to the under surface of the lever, and extending forward beyond the forward end, where it is linked to the strap l^1, of an excentric m^1, on the cam-shaft b^1, so that the rotation of the series of excentrics will vibrate the series of levers, and the arms g^1, linked to them, as above described. In front of the fulcrum i^1, each lever h^1, is provided with a set screw k^2, the end of which bears on the top of the spring-bar k^1, for the purpose of adjustment; and as the bar is only attached to the lever at the rear end, and rests against the end of the set screw, the whole of its length, from the point of attachment to the set screw, and from the set screw, to the point of attachment with the strap of the excentric, will act as a spring to yield, and prevent breaking, whenever the spade, which is operated by this arrangement (as will be seen hereafter), meets with some impediment. The position of the set screw may be changed, and, if desired, more than one such screw may be used on each lever. The spades l^4, are each attached to the lower end of short levers n^1, connected by a fulcrum-pin to the inner end of one of the series of arms g^1, there being one spade, and one such lever for each arm g^1, and the upper end of the levers n^1, are connected by connecting-rods o^1, with the lower end of an equal number of levers p^1, which are termed the tripping levers; the said levers being hung on a fulcrum-rod g^1, passing through the whole of them, and attached to the main frame. The upper end of these tripping levers is forced forward by a series of springs r^1, for the purpose of drawing back the spades as soon as they are

liberated. These tripping levers, like the levers h^1, before described, are made in two parts, attached together at the lower end, so that the forward part s^1, which is acted upon by cams, may have a springing action, in case there should be any impediment to the motion of the spades, and thereby prevent them from breaking. The spring part s^1, of these levers is bent forward at the upper end, and is acted upon by a series of cams t^1, on the cam-shaft, for the purpose of throwing up or tripping the spades, after they have been forced in to make the required cut in the earth.

The form of the cams, and their relations to the excentrics, as represented in fig. 2, is such, that the excentrics, in rising, force down the spades, which, by reason of being hung to the vibrating arms g^1, enter the ground in the arc of a circle, of which the distance from the cutting edge, to the centre of the rod f^1, is the radius; and as soon as the spades have reached the extent of their downward motion, which occurs as the excentrics reach the upper dead point, the part of the cams from 1 to 2 (see fig. 2,) acts on the tripping levers p^1, and forces them back, the effect of which is to give the spades a sudden tilting motion backwards and upwards, vibrating on the axis of the levers n^1; and as the cams rotate from the point 2 to 3 (see fig. 3,) they recede, so as to permit the spades to be vibrated forward by the tension of the springs r^1, which takes place by the time the excentrics have elevated the spades preparatory to another operation. The object of the tripping or tilting of the spades by a sudden motion, is to throw up and turn the earth over, and at the same time to disintegrate it, which operation is greatly aided by a shield-plate u^1, attached to the cross-piece of the auxiliary frame c^1; the said plate extending downward and being curved forward, so as to extend over the spades as they are tilted or thrown back; and, in consequence, the slice of earth cut by each spade is thrown up against the face of this shield-plate in such manner, that what was the lower end of the slice is carried up higher than what was the upper end; and as it is thus turned over and thrown up against the shield-plate, the spade returns, and the slice being no longer sustained by the spade, falls to the place from whence it was cut, but upside down, and, in falling, breaks up; the process of disintegration having been commenced by the action of the spade in cutting and throwing it up again.

The patentee claims, "the mode of operating the spades, by which they are made to perform the operations of cutting the slices from the land, throwing them up, and returning to repeat the operation, as set forth. Also, the mechanism for tilting the spades, or any mere modification thereof, in combination with the mechanism for giving the cutting action to the said spades, as described. Also, in combination with the spades, the use and application of the shield-plate, for aiding in disintegrating and reversing the slices as they are thrown up by the spade, as set forth. Also, in combination with the spades, the yielding or springing part of the levers for imparting the digging or cutting action to the spades, and the yielding or springing part of the tilting levers, as set forth, and for the purpose of preventing the mechanism from being broken when the spades meet with any obstruction, such as stones. And also, in combination with the spades, the driving and guiding-wheel."

To JOHN FOWLER, Jun., *of Havering, near Romford, Essex, for improvements in giving motion to ploughs and other agricultural implements.*— [Dated 1st January, 1857.]

HERETOFORE when ploughs and other agricultural implements have received motion by means of ropes wound round capstans or drums, driven by steam or otherwise, two of such capstans or drums have usually been mounted on the same horizontal axis, or on axes parallel to each other, which arrangements are in practice found to be inconvenient. Now this invention consists in mounting such capstans or drums on separate axes, placed at an angle to each other.

The invention also consists in moving the pulley anchors along the headlands by the power of the engine acting through the same rope as that which draws the plough. The rope from the winding apparatus passes first over a stationary pulley and then over the moveable pulley on the headland, from which it passes at right angles to the plough. To overcome the tendency which exists, when the strain is on the tackle, to draw the anchor of the moveable pulley towards the fixed pulley, the anchor of the moveable pulley is secured to an additional or supplemental anchor, which prevents it from moving while the plough is travelling; but when it is wished that this anchor should be drawn along the headland, it is only necessary to slacken the tackle which secures it to its supplemental anchor, and then the strain on the rope which draws the plough will cause it to move forward.

The invention also consists in a method of supporting and carrying the rope by which the plough is drawn, so as to prevent the rapid wear of the tackle which takes place when the rope lies on the land.

In Plate XI., fig. 1, is a plan of two capstans or drums, mounted on axes placed at an angle to each other, according to this invention. *a, a,* is a wooden frame, carried by the road wheels *b, b*; and *c,* and *d,* are the two capstans or drums, mounted on the axes *e,* and *f*; the axis *e,* also carries the pulley *g,* which is driven by a belt or strap, passing round the driving drum of a steam-engine. The capstan *c,* runs loose on the axis *e,* but it can be made fast to the axis by the clutch *h,* sliding longitudinally on the axis, which is made square for the purpose. *i,* is a handle for moving the clutch *h,* and it also moves the bevilled wheel *j,* into and out of gear with the bevilled wheel *k.* Thus it will be seen that either one or other of the capstans *c,* and *d,* can be caused to wind up its rope, and while one drum is winding, the other drum will allow its rope to run off freely. By placing the winding drums at an angle, the one to the other, a smaller number of pulleys will be necessary in some arrangements of the tackle for directing the ropes than is required when drums mounted on horizontal axles parallel to each other are employed.

Fig. 2, shews the general arrangement of the tackle employed when the power of the engine is to be applied to move forward the pulley anchors by means of the rope which draws the plough. *a,* is the winding apparatus, driven by the steam-engine, and which is placed at the end of one of the headlands. *b,* is a fixed pulley opposite to it on the other headland. *c, c,* are pulley anchors, which may be carriages mounted on disc wheels cutting into the land, as is described in the specification of former patents granted to the present patentee; or they may be carriages mounted on coulters or plates, which also, in a similar way, cut into the land, and so

anchor the pulleys attached to them. *d*, is the plough or tilling instrument. The pulley anchors *c*, *c*, are made fast during the time that the plough or tilling instrument is travelling to the posts or fixed anchors *e*, *e*, by means of ropes, having a series of loops or eyes formed in them, which drop over hooks attached to the pulley anchors; and when the plough or tilling instrument arrives at one of the anchors, the rope which connects it with the post or fixed anchor is detached, and the hook on the pulley anchor is shifted to the next eye of the rope. The plough or tilling instrument then returns to the other end of the land, and when the strain is brought on the tackle to draw it again to the first pulley anchor, this will move forward as far as the rope allows, and then the ploughing or tilling recommences.

Fig. 3, is a side view of one of the improved standards to support the rope along its course from the winding apparatus to the moveable pulleys on the headland. *a*, *a*, is a wooden pole, one end of which is driven into the ground; *b*, is a metal slide, capable of working up and down on the pole *a*; and *c*, is a pulley mounted on a stud axis *d*, carried by the slide *b*. *e*, is a pulley at the top of the pole *a*, over which passes the rope *f*, attached, at one end, to the slide *b*, and, at the other, to the sand-bag or weight *g*. It will be seen that when the strain is on the rope, it will press on the pulley *c*, so as to draw it towards the lower end of the pole *a*; and on the contrary, when the rope is slack, the weight *g*, will draw the pulley *c*, towards the upper end of the pole *a*, and so the rope will always be kept off the land.

To WILLIAM DRAY, *of Swan-lane, for an improvement in ploughs.*—[Dated 31st January, 1857.]

THIS invention relates to such ploughs as are provided with a share in the form of a pointed bar, and consists in the means of securing the bar in its position after having been pushed forward, as required from the wearing away of the point thereof.

In Plate XI., fig. 1, is a side view of so much of a plough fitted with a pointed share bar as is necessary to shew the improvement. Fig. 2, is a section of part of the same through the line *a*, *b*, of fig. 1. *a*, is the beam; *b*, is the coulter; and *c*, is a casting or main frame. *d*, is the share bar (which is of a dovetailed shape in cross section), inserted in a dovetailed recess or groove, formed or cast in the frame *c*. *e*, is a bulged part, cast or formed on the inside of the bar *f*, of the frame *c*. A recess is cast or formed in the front side of the bulged part, and in this recess a roller or collar *g*, which has its journals c^1, c^2, excentric to the roller, is inserted before the share bar is put in its place. The journals c^1, c^2, turn in bearings d^1, d^1, formed one on each side of the recess. The recess is large enough to allow the excentric roller *g*, to turn freely without touching. The projecting end of the journal c^2, is made square, so as to be easily laid hold of either by an ordinary spanner or by a key, such as is represented by the dotted lines e^1, e^1, whereby the excentric roller *g*, is caused to turn until its fullest part jams the share bar *d*, firmly in the dovetailed groove in the frame *c*, and bar *f*, as shewn. To release the share bar, the excentric roller *g*, is turned into the position indicated by the dotted lines f^1, when the share bar *d*, can be regulated as required. Fig. 3, represents the excentric roller detached.

The patentee claims, "the construction of ploughs, which are provided with moveable share bars, in such manner that the share bars can be tightened or slackened by means of an excentric roller or collar, or by more than one roller or collar, as described, and represented in the drawings hereunto annexed."

To Robert Reeves *and* John Reeves, *of Bratton, Westbury, Wiltshire, for improvements in machinery for delivering manure for agricultural purposes.*—[Dated 17th January, 1857.]

This invention has for its object improvements in machinery for delivering manure for agricultural purposes. For this purpose, the manure is placed in a suitable box or trough, mounted on a proper carriage. The box or trough is formed with a curved bottom, and may be made with any number of openings for the passage of the manure; and over each opening is a slide or cover. At the lower part of the box or trough a rotating axis works, and on this axis there are fixed inclined blades or portions of screws, such blades or portions of screws being each of such a width as to move the quantity of manure desired; and the peculiarity of the invention is, that the inclined blades or portions of screws which are to bring up or move the quantity of manure to an opening, are inclined to the axis in opposite directions. The manure, after it has been caused to pass through the openings of the trough or box, may be deposited or distributed on or in the earth, as heretofore, or in any other convenient manner.

In Plate XI., fig. 1, is a side view of an ordinary seed-sowing machine, having apparatus for delivering manure, arranged according to this invention, attached to it. *a, a,* is the frame of the machine, which is carried by wheels in the ordinary way. On the frame *a,* is mounted a box *b,* for containing seed, which is distributed in the usual manner. *c,* is another box, fixed in front of the box *b,* and which is intended to contain manure; it has holes at its lower part for the discharge of the manure into the funnels *d,* placed underneath, to receive and deposit it on the land. *e,* is a spur-wheel, mounted on the axle of the wheels which carry the frame; the spur-wheel *e,* drives another spur-wheel *f,* mounted on the axis *g,* which passes through the manure box. On the axis *g,* a series of inclined blades *h,* are mounted, as shewn in figs. 2, and 3, which shew respectively a longitudinal and a transverse section of the box *c,* and these blades are inclined in opposite directions, so as to drive the manure towards the holes from the spaces between them; and over each of the holes four blades are mounted, two inclined in one direction and two inclined in the other direction, by which the manure over the holes is kept in constant movement backwards and forwards. In order to regulate the discharge of the manure, a slide *i,* is employed, by means of which the holes in the box *c,* can be closed to a greater or less extent. The slide *i,* extends the whole length of the box, and has formed on it two toothed arcs, to work the pinions *j,* on the axis *k,* on which also a handle *l,* is mounted, and by this the slide is actuated.

To Henry Chamberlin, jun., *of Narborough, in the county of Norfolk, for improvements in implements or apparatus for ploughing, tilling, or cultivating land.*—[Dated 21st January, 1857.]

This invention relates to implements or apparatus for tilling the soil as a substitute for the ordinary plough, which apparatus is not only calculated to turn over the soil but also to break and pulverize it at the same time, so as to dispense with the operation of harrowing for the purpose of breaking the clods.

In Plate XI., fig. 1, represents a side elevation of the improved apparatus, and fig. 2, is an end view of the same. *a*, a^1, is a single thread screw of cast-iron, or other suitable metal, the boss of which is fitted on a shaft, which has pivots fitted in the bearings *b*, *b*, depending from the rectangular frame *c*, *c*. This frame is of plate-iron, and the pendent arms *d*, *d*, are as thin as possible, so as to pass easily through the ground. *e*, is the coulter, being a continuation of the arm *d*, which penetrates the ground to a depth a little below the depth of the screw blade; *f*, *f*, is an upper rectangular metal frame, suspended on wheels *g*, *g*, the axletrees of which are connected with the frame *f*, by means of locking plates *h*, *h*, somewhat of the ordinary character used in road vehicles, in order to afford facilities for turning the machine round. *i*, *i*, are hand levers fixed to the moveable locking plate, for moving the wheels to effect such purpose. These same levers also spring into notches in the frame, to fix the wheels in position for travelling in a straight line. The lower screw frame *c*, is suspended from the upper frame by four racks *k*, *k*, fixed thereto; these racks take into four pinions *l*, fixed in pairs on the cross shafts *m*, *m*, by which the racks and frame *c*, *c*, are sustained. The shafts *m*, *m*, are each furnished with a cross hand lever *n*, by which the lower frame can be elevated or depressed, in order to adjust the frame *c*, and screw *a*, a^1, in any suitable position, in which it is fixed by securing the hand levers *n*, to suit the depth to which the screw *a*, a^1, is to be inserted into the soil; or it may be withdrawn from, and be altogether above, the ground. *r*, *r*, are guides, to control and keep the lower frame *c*, *c*, in position when adjusted, and during its rise and fall; *p*, is the traction chain, by which the implement may be drawn, either by yoking horses or other animals thereto, or by a portable steam-engine moving in advance of the implement; or it may be drawn by means of a stationary steam-engine, or by other stationary power communicated by traction ropes or chains, as now well understood in agricultural operations. The hand lever *i*, in the rear of the machine, may be used for steering it parallel to the last furrow or line of soil previously operated upon. It will be observed that the screw *a*, a^1, consists of a single thread or leaf throughout its length, but that it is not of the same pitch throughout; the part *a*, in advance, or that which takes the lead when it is drawn through the soil by the traction chain *p*, is of considerable less rake or pitch than the after-part a^1. Now in pulling this implement through the ground, the coulter *e*, first cuts and opens the ground, into which the screw enters, and by the force of the traction worms or screws itself through the soil. A considerable length of the screw at the first end *a*, is of the same pitch, so that having entered the ground, this part takes a firm hold of the soil in which it is embedded, and in which it forms a matrix. By thus taking hold of the soil at the fore-part *a*, it holds a command over the after-part of the screw, which becomes

imbedded in less solid ground by reason of its being broken up by the part in advance; the effect of which is, that the after-part a^1, of the screw being of much greater pitch than the fore-part, will turn and break up the ground and move it sideways to a greater or less extent, according to the depth of its immersion in the soil, and will form a furrow somewhat in the manner of an ordinary plough, but with this difference in effect, that the ground, instead of being inverted in a solid mass, will be pulverized and broken up to the extent desired. It will be observed that the pendent arms *d, d,* coulter *e*, and bearings *b*, are thinned or pointed, to ensure their easy passage through the soil.

Fig. 3, represents, in side elevation, a modification of the improved implement. The frame *c, c,* bearings *b, b,* &c., are the same as before described. a^1, a^1, a^1, are detached portions of the thread of a screw of a different pitch, which breaks up, inverts, and pulverizes the soil as required, by reason of the control exercised over them by the part *a*.

Fig. 4, represents a side elevation of a further modification of the implement made according to this invention. The leading and controlling part of the screw *a*, is the same as before. In this the working part of the screw is composed of a series of tines or radial projections *t, t,* arranged in the form of portions of screws, but of different pitch or rake to that of the screw *a*, whereby these tines are caused to operate on the soil as before. A further modification may be made, in which the controlling screw is the same as in all the preceding arrangements, except that the radial tines are placed in straight rows, and which produce the desired result in tilling, but with less advantage than is attained by the arrangement just described.

The patentee claims "the adaptation and application of screw leaves, threads, or blades, in combination with other screw leaves, threads, or blades, of a different rake or pitch, or with other parts, for tilling or operating on the soil, as hereinbefore represented and described."

To JOHN NAYLOR, *of Winterton, near Brigg, Lincolnshire, for improvements in horse hoes.*—[Dated 17th February, 1857.]

THE object of these improvements in horse hoes is to render each of the hoes capable of being moved to and from its neighbour, in order to admit of varying their distance apart, and yet allow the whole series of hoes in the machine being moved laterally, according to the requirement for the time being.

In Plate XI., fig. 1, is a transverse section, and fig. 2, part of a front view, of a horse hoe, constructed and combined according to this invention. *a, a,* are the wheels which carry the machinery: these wheels turn on the axle *b*, which is fixed to the frame *c, c.* At the front of this frame shafts are fixed at c^1, c^1. Below the frame *c*, is suspended a bar *d*, by means of slings *e*, one at each end of the bar; and below the bar *d*, there is a shaft *f*, having its bearings at each end of the bar *d*, as shewn. On the shaft *f*, there are as many tubes *g*, as there are hoes. These tubes have toothed racks formed on their upper surfaces, and the tubes are capable of turning freely on the shaft *f*. On each of the tubes *g*, is a socket *h*, which embraces, and is capable of sliding on, its tube. To the under part of each sliding socket *h*, is affixed the end of a lever *i*, which carries a hoe

or cutter j, and it also has a wheel k, to support it, as shewn. Each of the levers i, has a shaft j^*, turning in a suitable bearing j^1, as shewn. At one end of each of the shafts j^*, is a handle j^2, by which it can be turned; and at the other end is a pinion, which turns within a recess formed in the upper part of each of the sliding sockets h. The upper part of each socket is open, to admit of the teeth of the pinion which revolves therein, gearing with the teeth of the rack on which the socket slides. Hence it will be understood, that the position of the lever of any of the hoes may be moved to or from its neighbouring levers on either side, and the whole of the levers and hoes are capable of being moved laterally, by reason of the curved rack fixed on the upper side of the bar d, which is acted on by the pinion l, on the axis m. The depth at which the hoes or cutters shall work is regulated by means of chains n, each of which is attached at one of its ends to a roller o, and the other end of each chain supports one of the shafts j^*; and according as the roller is turned by means of the axis p, and bevil pinions q, q, to wind up or unwind the several chains, so will be the positions of the hoes or cutters. The roller o, is retained from turning by the ratchet wheel r, and catch s.

The patentee claims, "the combination herein explained"

To WILLIAM WOOD PILCHER, *of St. Margaret's at Cliffe, Dover, for improvements in straw shakers of thrashing machines.*—[Dated 10th February, 1857.]

THE figure in Plate XI., shews in side elevation the improved straw shaker. a, a, is a series of endless bands or cords (or chains may be employed in lieu thereof), parallel from end to end of the shaker. These bands a, a, are kept distended on pulleys b, b, and c, c, fixed excentrically on axles e, and f, in opposite directions, in such manner as to bring the bands a, a, successively into action. The axle e, receives motion through a pulley from a band g, which passes around the pulley h, on the axis of the drum or beater. The axles e, and f, are connected together, and communicate motion the one to the other, by means of the connecting link i, attached to arms e^1, f^1, on the axles e, and f, or they may be made to communicate motion to each other only by the series of bands a, a.

In order to allow of the bands a, a, being tightened up after being placed, the axles e, and f, are arranged to work in slots, provided with suitable tightening screws; and the connecting link i, will also be made in two parts, such parts being connected with screws, working in slots, so as to admit of its length being adjusted.

The patentee claims, "the employment of endless bands arranged on pulleys, to form straw shakers of thrashing machines, &c., as herein shewn and described."

To THOMAS GEORGE SHAW, *of Great Saint Helens, Bishopsgate, for an improved thrashing and winnowing machine, which he calls "flail thrashing machine," for corn and other grain.*—[Dated 26th February, 1857.]

THIS invention relates to a novel construction of machine for thrashing and winnowing corn and other grain, in which the thrashing is performed

by beaters or flails acting in a similar manner to the ordinary hand-flails.

In Plate XI., fig. 1, is a plan view of the improved thrashing and winnowing machine, with the cover removed; and fig. 2, is a vertical section of the same.

The machine is composed of a wooden frame *a, a*, to which the boards or planks *b, b*, forming the sides, are nailed or otherwise fixed. The bearings *c, c*, are bolted to the top of the frame, and support the main shaft *d*, at one end of which is a pulley d^1, receiving motion from any prime mover. Upon this shaft (to which a fly-wheel may be fitted, if necessary,) are keyed two or more arms *e, e*, to which are fixed the rods *f, f*, for supporting the flails or beaters *g, g*. The corn to be thrashed is fed into the machine through the hopper *h*; it then falls upon an endless travelling band *i*, which, if necessary, is carried over the table *j*, perforated with holes, to allow the thrashed grain to fall through. A slow motion is given to the endless band, which passes round two grooved or roughened rollers *k, k*, by a large pulley *l*, driven by a strap or band *m*, on the small pulley *n*, made fast on the main shaft. As the band travels along, it carries the wheat with it, which action is further assisted by the grooved roller *o*, fixed to an axis *p*, and placed over the band. This grooved roller receives motion from a pulley *q*, connected by an endless band with another pulley *r*, of the same diameter, fixed on the shaft *s*. This arrangement causes the corn to be fed on the perforated table *j*, in a regular manner, and of uniform thickness. The corn so fed upon the table is submitted to the action of the flails or beaters *g, g*, which are formed of hard wood, and are each screwed to an iron hinge or support *t*, working loosely on the rods *f, f*. The flails, when they receive a rapid rotatory motion in the direction of the arrow, rest upon the projecting rods *u, u*, fixed to the arms *e, e*, in their descent, so as to come direct and flat upon the corn or other grain placed on the table *j*. In their rapid rotatory motion they beat out the grain from the ears in the manner of the ordinary hand-flails, and the grain then falls through the holes *v*, in the table *j*, upon the incline *w*. Any grains of corn which are carried along with the straw, pass through the bars or rods *x, x*, and then fall upon another incline *y*, which conducts the thrashed corn to the rocking-sieves or riddles *z, z*, for the purpose of removing dirt and other impurities contained therein. These riddles are suspended by chains to the sides of the machine, the upper sieve being of a coarse mesh, and the lower of a fine mesh. A rocking motion is given to the sieves by means of a connecting-rod *b**, working loosely on a stud-pin *c**, on the pulley *d**. The connecting-rod *b**, is attached at its opposite end, by a universal joint, to a bell-crank lever *e**, to one arm of which is fitted a small rod *f**, connected to the upper sieve *z*. The dirt and other impurities, thus separated, fall upon the floor, and are removed at the back of the machine. The thrashed corn, when it is being sifted or riddled, is exposed to the action of the fan *i**, which is driven at a great velocity by a small pulley *j**, fixed to the axis *k**, and driven by a strap or band *l**, on the pulley *d,** keyed to the main shaft. The fan winnows the wheat, and blows all the husk and other light substances against the canvas *m**, whence, falling on the floor at the back of the machine, they may be drawn out by any suitable means. The corn being thus thrashed and dressed, falls upon the incline *o**, which conducts it to the front of the machine.

The patentee claims, "the peculiar arrangement and construction of a

machine for thrashing corn and other grain; in which machine the thrashing is performed by means of beaters or flails acting in a similar manner to the ordinary hand-flails, as hereinbefore described, and represented in the annexed drawing."

To HENRY BRADLEY *and* ELMITT WRAY, *both of Hull, Yorkshire, for improvements in beaters used in thrashing machines.*—[Dated 14th March, 1857.]

THIS invention, for improvements in beaters for thrashing machines, consists in applying to the ordinary wooden beaters strips of iron or other metal, so arranged as to form channels crossing diagonally on their face, and thereby constituting an irregular diamond-shaped surface; or, in place of this, the iron strips are so arranged as to form the beater complete, and are fixed directly on the drum centres, without wood. Wire is also proposed to be wrapped round, or fixed on, the ordinary wooden beater, so as to form a similar irregular diamond-shaped surface, as above.

In Plate XI., fig. 1, is a plan view of part of the improved beater; and fig. 2, is a cross section of the beater plate. *a*, is a strip of iron or other suitable metal, which is made of a size to fix on to the drum, or to the ordinary wooden beaters. A series of channels are formed on the beater-plate *a*, crossing each other at any desired angle, thus leaving irregular diamond-shaped tapered projections *c*, *d*, *e*, between the points of intersection. These rows of projections can be of various sizes, or they may be all formed of the same size. The projections *c*, *d*, *e*, may be forged or cast on to the beater-plate, or may be fixed in any other suitable manner. *f*, *f*, are holes, through which screws are passed to secure the plate to the drum.

The patentees claim, "the forming of beaters used in thrashing machines, with raised diamond-shaped projections on the surface thereof, as hereinbefore described."

To THOMAS BALL *and* JOHN WILKINS, *both of Nottingham, for improvements in manufacturing looped fabrics, suitable for the making of gloves and other articles.*—[Dated 8th January, 1857.]

WHEN making warp looped fabrics, according to this invention, a warp of woollen yarn and a warp of spun silk yarn are used. The warped threads of woollen yarn are looped on to the needles to make the woollen fabric, whilst the yarns of spun silk, which are to be on one surface, and are to be formed into a pile or raised into a nap or fleece after the fabric has been milled or felted, are not looped on to the needles; and when making knit-looped fabrics, according to this invention, the woollen yarn is laid on to, and sunk between, the needles, so as to produce a woollen fabric, and the spun silk yarn is worked in as a pile, or so as to be raised after the fabric has been milled or felted. The fabrics thus produced are to be milled or felted, and raised in the ordinary manner. By these means, a peculiar woollen looped fabric, with a silken nap or fleece, will be produced, very applicable to the making of gloves and parts of garments. The woollen warps are carried and actuated by a single guide-bar, having as many

guides as there are needles in the warp machine; and the warps of spun silk are carried by the guides of a second guide-bar, which is actuated in such manner as not to loop the spun silk warps on the needle, as is well understood. The fabrics, when made in a warp machine, are next to have the pile on the silk side raised, by teazles or wire cards, and then to be milled or fulled, tentered, raised, cropped, and finished, as is well understood in finishing woollen cloths. It is not essential that the pile warps should be wholly of spun silk, as other fibre may be used therewith.

By this mode of manufacturing looped fabrics, it will be understood that the body or ground is in each case a felted woollen fabric, whilst the fleece or pile on one side in each case is of silk, or it may be silk with other fibre; and it is the manufacture of a felted looped fabric of wool with a fleece or pile of silk, or partly of silk, which constitutes the peculiarity of the first part of the invention.

The second part of the invention consists of the manufacture of similar looped fabrics when using knitting machinery.

In carrying out this part of the invention, a yarn or thread of wool, and a yarn or thread of soft spun silk (silk waste), are laid on to the needles or worked into a fabric in such manner that the two surfaces of each fabric may be produced, the one by the wool, and the other by silk, as is well understood; and the same separately is not new. The fabrics thus produced are to be raised on the silk side to produce a pile of silk; the fabrics are then to be milled or fulled, tentered, raised, cropped on one or both sides, and finished. It is preferred that the threads or yarns used should be dyed in the fleece or in the yarn, and it will be evident that each fabric may be of different colors, or of the same color, on the two sides. The wool surface of each fabric may or may not be raised and cropped, or otherwise finished, after fulling.

This part of the invention consists in producing a fulled or milled knit fabric of wool with a piled or fleeced surface of spun silk or partly of spun silk.

To JOHN LONG, *of Tiverton, Devonshire, for improvements in the fastenings of brooches and other articles of jewellery.*—[Dated 17th January, 1857.]

THIS invention is designed for affording greater security to the fastenings of brooches and other articles of jewellery than heretofore. Instead of connecting the pin or fastening thereof to the brooch by a hinge-joint, as heretofore practised, the pin is connected to the brooch by a hooked spring catch, attached by one end to a forked-shaped piece of metal, securely fixed to the back of the brooch, and disposed across, or at right angles to, the aforesaid pin when connected to the brooch. At another part of the brooch, and opposite to the before-mentioned forked piece, is affixed a solid ring catch, instead of a divided ring or cycloidal-shaped catch, as commonly employed, to receive the point of the pin.

In Plate XII., fig. 1, is an elevation of one of the improved fastenings for brooches and other articles of jewellery; the front plate of the box of such fastening being removed to expose the mechanism contained in the box; and fig. 2, shews the same applied to a brooch. Fig. 3, shews another form of fastening for brooches and other articles of jewellery,

and fig. 4, a detached portion, hereinafter referred to. A, is a box of thin metal, within which are arranged the hooked catch-piece B, and helical spring C, enclosed therein by a plate, which is connected to the box by small screws *a*, *b*, *c*. The screw *a*, serves as the fulcrum of the catch-piece B, and the screw *b*, serves as a stop to limit the extent to which the catch-piece is forced and held back or locked by the pressure of the spring C. At fig. 2, E, is a tongue-pin, hinged to the frame of the brooch in the usual way. The box A, is soldered to the frame by the part 1, at fig. 1.

The patentee remarks, that the great practical objection to the use of tongues or pins when hinged to articles of jewellery, as heretofore commonly practised, consists in the hinge working loose, and ultimately being broken by the frequent insertion of the aforesaid tongue or pin into the article to be fastened thereby. Now in order to remedy the above objection, and to enable brooches and such like articles of jewellery to be more readily and securely affixed to articles of dress than heretofore, it is proposed, instead of hingeing the tongue or pin of the brooch or other article of jewellery to the frame thereof, to make it distinct and separate therefrom, as at fig. 3, and to attach such tongue or pin to the frame in the following manner:—A hook or ring *d*, is soldered to the frame of the brooch at one end, and at the other end is soldered the improved spring-catch. The tongue or pin E, is enlarged at 2, and 3, so that when the said pin is attached to the brooch it shall not be capable of being detached therefrom, except by drawing back the spring-catch B. In using the above improved fastenings, it is only necessary to press the tongue or pin E, upon the top of the catch B, by which the catch will be pushed back until the pin has passed the point thereof, and the catch B, being forced back into its original position by pressure of the spring C, thereon, the brooch will be made secure. And as regards the improved fastening shewn at fig. 3, the pin E, is first passed through the material to which the brooch or other article of jewellery is to be attached. The ring or hook *d*, is then passed over the point of the pin E, and the other end of the pin pressed past the spring-catch B, as before stated.

The patentee claims, "First, the spring-catch exhibited more particularly at fig. 1. Secondly,—the mode exhibited at fig. 3, of connecting the tongue or pin of a brooch or other article of jewellery to the frame thereof, as above described."

To JOHN WOODLEY *and* HENRY HERBERT SWINFORD, *both of Limehouse, for improvements in sawing machines.*—[Dated 5th March, 1857.]

THIS invention consists in certain mechanical arrangements of wood-sawing machines, to produce suitable curves when sawing wood for staves and other like purposes.

The figure in Plate XII., is an elevation of the saw-bench, frame, and template. *a*, is a revolving template; *b*, b^1, a stave of wood; *c*, a binding roller; *d*, friction rollers; *e*, the bench or table; and a^*, a regulating screw. The band or other saws work through the bed-plate, or table of the sawing machine, between two guide rollers, one of which is a plain binding roller; the other, acting as a template, is a cam or excentric, furnished with points or like means for carrying the wood forward, and is adjusted by a regulating screw. Two or more roughened guide rollers *d*, are placed in any convenient position for guiding the wood while being

sawn. Templates of the common form may, however, be substituted, made of leather, gutta-percha, vulcanized india-rubber, or other flexible materials.

The patentees claim, "the novel mechanical arrangement of wood-sawing machines, as described."

To JOHN MAYO WORRALL, *of Salford, for an improvement in finishing certain descriptions of fustians, called "cords" and "thicksets."*—[Dated 31st January, 1857.]

THIS invention relates to the finishing of that particular description of fustians which are well known by the names of cords and thicksets; and consists in finishing cords and thicksets in a similar manner to the present method of finishing other fustians, called beaverteens. The surface of the cloth (as it comes from the loom) is raised by the operation of the ordinary and well-known raising machines, and subsequently the fabric is submitted to the operation of the ordinary and well-known shearing machines, as usually employed in shearing other fustian goods. This method of, or improvement in, finishing cords and thicksets, is employed in place of the ordinary method of finishing such goods or fabrics, by cutting up the loops or cords upon their surface, to form the pile or finish, the result of such improvement being the production of a finish of a very different and distinctive character, and not hitherto attained in cords and thicksets.

The patentee claims, "the finishing of that description or make of fustians called cords and thicksets, by means of raising the surface of such goods, and subsequently shearing the same, such finish being effected or attained by the operation of the ordinary machinery, as employed in finishing beaverteens."

To JAMES MURDOCH, *of Staple-inn, for an improvement in the process of treating the threads of floss silk, which is also applicable to the threads of other fibrous materials,—being a communication.*—[Dated 9th February, 1857.]

THE object of this invention is to impart to single threads, as produced by carding and spinning, and more especially to threads of spun floss silk, the appearance of threads of raw silk, their properties, and value—without down, and without having recourse to twisting or singeing—by replacing factitiously the gummy portions of the cocoons of silk, and also the crossings of the spinning or reeling of the cocoons, by a rubbing or friction, which produces smoothness of the threads; to which result the swiftness of the reel upon which the thread is wound at the close of the operation contributes.

In carrying out this invention, the threads are immersed in water in which gum or size is dissolved, which has the effect of straightening the fibre by a kind of untwisting; then these fibres undergoing a sort of drawing or stretching, by their unwinding and reeling, their straightened fibres assume a parallel direction amongst themselves, which is rendered permanent by the size or gummy material; and at the same time, the

friction which the thread is exposed to in this wet state, smooths it, and renders it soft and glossy, whilst the fibres cannot become separated, thereby producing a homogeneous thread, as indecomposible as the thread of raw silk: by this means, therefore, is obtained a smooth, solid, glossy, and shining thread, instead of a downy thread without strength, like that of spun floss silk.

It will be apparent, that the mechanical carrying out of this process may be effected in various ways, since it is merely to cause the thread to plunge in a vessel containing a solution of size or gum, and afterwards to deprive the thread of its water, at the same time causing it to rub against substances which will render it smooth; and that during this time it shall undergo a species of drawing or stretching before it is wound, in a dry or nearly dry state, upon the reel, from which it is afterwards withdrawn to form a skein.

In Plate XII., fig. 1, represents a side elevation of the machine employed for carrying the invention into effect; and fig. 2, a front elevation of a small portion of the same. Only one reel is shewn, as the number may be varied according to the size of the place where the machine is at work, or to the strengh of the frame. Fig. 3, represents a mode of throwing into and out of gear by friction, to set in motion, or to stop the reel (the dotted lines indicate the position of the parts when in gear, and the black lines the position of the parts when out of gear). A, is the frame of the machine; B, the pan, containing a solution of size or gum, in which is plunged the thread which is to be operated upon; *b*, a cock for wholly or partially emptying the pan; C, a pipe by which steam, produced by any kind of generator, is brought into the pan to heat the water therein. D, is a bobbin, upon which is wound the thread which is to be operated upon, and which is placed outside the pan; E, the plunger for immersing the thread coming from the bobbin in the water in the pan in which the gum or size is dissolved. This plunger carries a sponge *e*, as also a tube of glass e^1, against which the immersed thread passes. Before the thread from the bobbin is immersed in the pan, it passes over a glass roller e^{11}, which serves as a guide and support to it. The effect of this first sponge upon the thread, is to smooth it in giving it the first pressure. F, F, are sponges against which the thread (drawn by the reel, as hereafter explained) undergoes sundry rubbings, for the purpose of pressing and smoothing it, and to deprive it of the water with which the said sponges become charged by their contact with the thread. These sponges are held in sliding pincers or sponge-holders *f*, the inner ends of which are supported by an upright A^1, connected to the frame A, of the machine. This end of the sponge-holders is fastened to the upright A^1, by binding screws f^1, which allow the sponges to be drawn forward or backward, according to the angle which it is desired they should form with each other, with a view to the rubbings, the pressure, or the drawing of the thread, according as the thread requires to undergo these operations in a greater or less degree. G, is a glass ring to guide the thread on to the reel. This ring is mounted upon a sliding bar G^1, suspended from the frame at *g*, and is capable of a horizontal movement, to and fro, by means of the diagonal guidance produced by the cylinder G^{11}, which has a groove g^{11}, cut in it (see fig. 2). This cylinder receives motion from the pulley g^1, which itself is set in motion by the prime mover of the machine. H, is the reel upon which the thread is wound as fast as it undergoes the treatment which constitutes

this invention; the chief object of which is to give it that smoothness of texture which it acquires by such treatment. It will be readily understood that, the end of the thread being made fast to the reel, the reel will, in turning, draw the thread, which will thus be wound upon it. J, is a friction-roller, mounted upon the axle of the reel H, to cause the latter to turn. The said roller receives a rotatory motion from the drum K, by contact with it. When it is wished to stop the reel, it is thrown out of gear with the roller J: fig. 3, shows very clearly this double action. Suppose this part of the machine to be in gear, as shewn by the dotted lines, if it be wished to throw it out of gear, to stop the reel, whether because a thread has broken, or because the reel has enough thread upon it, the workman draws towards him the handle L, which then becomes heavier than the weight M: it follows, that in causing the handle to turn downwards, the axis of the roller becomes displaced, which effect is due to the displacement of the weight M, which being displaced, no longer causes the contact of the roller J, with the drum K, and hence the throwing out of gear. An opposite manœuvre effects the throwing into gear: that is to say, the weight being thrown into its former position, renews the contact or throwing into gear, by the operation of the weight upon the roller.

Instead of the sponges F, F, rollers covered with cloth may be substituted. Upon a small wooden cylinder are fixed, by any suitable means, pieces of cloth, standing edgeways, or radiating from the centre: when set close together, their periphery presents nearly a smooth surface, which has the advantage of rendering the thread passing over it smooth and glossy, whilst it is still slightly damp. These rollers are mounted upon spindles, which admit of their being changed when they become too wet. Rotatory motion is communicated to them by wheels, which are driven by a pulley, over which passes a strap, communicating with another pulley, placed upon the axis of the drum K.

From what has been said above, it will be readily understood that, when it is wished to treat a thread of spun floss silk, for example—that is to say, a single thread produced by carding, drawing, and spinning, and not twisted nor combined with other threads, nor milled—all that is required is to place the bobbin, upon which it is wound, in a suitable position near the pan, or the compartment of the pan, in which the thread is to be immersed. In this pan there has been, in the first place, dissolved some gelatine or animal size, known as Flanders size or glue, in the proportion of 900 to 1200 grains to a pint-and-a-half of water, according to the thickness of the thread, the quality of the size, and the temperature, and other indications which practise only can give. It is the same with respect to the heat of the water in the boiler, which should be similar to that in the pans in which the cocoons are placed when the thread is being wound off them. Having detached one end of the thread which is on the bobbin, and having immersed it in the pan, through which it continues to pass (being held down by the plunger), then placing it against the sponges, and having passed it through the glass ring, and, lastly, having made fast the end of the thread to the reel, a rotatory motion is given to the reel in the manner described, and the thread is reeled off the bobbin. The thread, as it passes, becomes moistened, and in stretching, occasions an untwisting or partial separation of the small fibres which are twisted together, so as to place these fibres parallel to each other, in which position they are retained by the gummy substance dissolved in the water. Then, partly to facilitate

the drawing or stretching, and also to render the thread smooth and even, by giving it a gloss, the sponges against which it rubs complete the operation, which terminates by the drying of the thread by the operation of the reel. Thread thus treated may be subsequently employed in the manufacture of twisted threads, edgings, and tissues, in the same manner as silk from the cocoon. Now, when the reel is sufficiently charged with thread, it is thrown out of gear to stop it, and it is removed and replaced by another. The reel thus removed is placed upon a rack to dry. When dried, the thread is removed and folded in the ordinary way, if the reel employed was of the size of those usually employed in the trade. Sometimes this reel is made of twice the usual size, which facilitates the drying; but in this case, the skeins are reduced to the dimensions adopted in the trade: the large skein is then reeled on to a smaller reel. This supplementary operation is rather favourable than hurtful to the treatment of the thread of floss silk—rendering it smooth, even, and glossy, without being slack. Sometimes cylinders or rollers, covered with stuff or cloth, placed edgeways, and presenting a surface which smooths and polishes the thread, are placed above the sponges. The surfaces of these cylinders or rollers are also arranged for intermitting rubbings, that is to say, that between the parts covered with cloth, smooth or polished parts are interposed.

In cases where threads of floss silk, treated by this process, are intended to be scoured and dyed, without being doubled or milled with a strong twist, they are subjected, after dyeing, to a second operation, analogous to the preceding one, that is to say, after winding them upon a bobbin, they are subjected to the action of this apparatus as before, but with this difference, that instead of Flanders size or glue, white isinglass or fish-glue, or glue from fish-scales, or colorless mucilages, or white gums, like those which are employed for dressings, are used. In order that the gums may not cover or disguise the colors, gelatine is sometimes employed in this second operation, which has been colored in the course of its manufacture to a color like that to which the floss silk has been dyed after the first operation.

The process is also applicable to the improvement of raw silk badly spun, downy, or hempy, as well as to all threads of silk of an inferior quality, the produce of waste silk, and worm-eaten cocoons spun by machinery or otherwise; which are rectified or improved by the application of the process hereinbefore described.

The process is likewise applicable to threads of cotton, flax, hemp, and other fibrous materials obtained by what is properly called spinning, in whatever way conducted; provided only that these threads are not doubled or milled, and have received no other twist than that which is given in the spinning, and which is necessary to maintain the aggregation or blending of the filaments or fibres which form the thread. In fact, it will be understood that if, on the one hand, it is necessary that the thread should be single, to render the action of the operation hereinbefore described for floss silk applicable to cotton, linen, hempen, or other threads; on the other hand, it will be understood that this action will be exerted in like manner as for floss silk, by selecting amongst the sizes or gums those which come nearest to the essence of the material, or which are employed as dressings for threads of the kind, and by giving to the bath a temperature suitable alike to the nature of the different kinds of threads, to their quality, their

coarseness, the purposes to which they are to be applied, and, in short, to the indications of practice, which are readily seized by a competent workman.

The patentee claims, "Firstly,—the transformation, not heretofore effected, of the thread of spun floss silk into a thread which, in evenness, brilliancy, smoothness, and strength, approaches as nearly as possible to raw silk in these respects, that is to say, without down, and consequently not requiring that stuffs made with such thread should be subjected to the process of singeing, as in the case of stuffs made from threads of floss silk, which have not been subjected to my process. Secondly,—the employment for this purpose of the principle of spinning or reeling silk from cocoons, by adding to the apparatus ordinarily employed, or to any other apparatus suitable for such reeling, gum or size to the pan, and in making the wet thread as it leaves the pan, pass over spongy or other analogous substances which have the property of depriving the thread of the water and making it even by rubbing, at the same time that it undergoes a sort of drawing or stretching, which, in laying parallel the fibres of which the thread of floss silk is composed, gives it a smoothness of texture similar to that of raw silk, and causes to disappear the down, produced by the manner in which the small fibres were originally ranged among themselves. Thirdly,—the application of the same process to threads of cotton or wool, to give them smoothness of texture, and the same qualities which the process gives the threads of floss silk. Fourthly,—the application of the same process to threads of silk, flax, hemp, or cotton which are defective, badly spun, downy, or hempy, for the purpose of rectifying them, improving their sorts and qualities, and rendering the use of them more easy and extensive in manufactured articles, since, in lieu of shewing a down in these articles, and having recourse to singeing, my process renders the operation of singeing unnecessary."

To JOHN HENRY JOHNSON, *of Lincoln's-inn-fields, for improvements in the treatment of floss silk,—being a communication.*—[Dated 3rd April, 1857.]

THIS invention relates to an improved mode of treating floss silk, whether in a raw or spun state, whereby its texture and properties are greatly improved, and a very superior article is produced. For this purpose, the inventor employs a solution, composed of about 28¼ drams, avoirdupoise, of caustic soda, caustic potash, or ammonia, to about 2¼ gallons of water (care being taken that the water be previously freed from all calcareous salts). This solution is raised to the temperature of about 176° Fahr.; in it the floss silk to be acted upon is placed, and allowed to remain the requisite time: the proper length of time can be readily ascertained by the naked eye. It is then withdrawn, and well washed in pure water. If the material under treatment be required to be dyed black, it is placed in a solution of sulpho-nitrate of iron; the material is then washed, after which it is immersed in a solution of caustic soda, potash, or ammonia, similar to that above described. By this process the salt of iron which the silk contained is converted into peroxide of iron. The silk is then washed, and afterwards plunged into an acidulated solution of prussiate of potash, and again washed. After this operation, the silk is "galled," by being

steeped in extract of chesnuts, or some similar bath; after which it is again washed, and when dry, the process is complete, and the material is ready for the market.

The patentee claims, "First,—the system or mode of treating floss silk, whether in a raw or spun state, for the purpose of improving its texture and properties, as hereinbefore described. Second,—the system or mode of dyeing floss silk, hereinbefore described."

To JOHN HENRY JOHNSON, *of Lincoln's-inn-fields, for improvements in the manufacture of hard india-rubber,—being a communication.*—[Dated 4th April, 1857.]

THE first part of this invention relates to an improved mode of preparing hard india-rubber, whereby it is rendered homogeneous, sound, and free from imperfections arising from the presence of small holes or cavities therein.

In order to improve the quality of the hard india-rubber, there is mixed with the raw india-rubber, after it has been cut and dried, and well broken under rollers, about half its weight of finely-powdered sulphur, and a similar quantity of finely-powdered coal or fine wood sawdust—by preference, mahogany or rosewood dust—alone or in combination. Thus, to one hundred pounds of india-rubber are added about fifty pounds of powdered sulphur and fifty pounds of powdered coal or sawdust; the whole is then well mixed together by means of rollers, and formed into sheets, if required in that form, and placed on tin or glass plates to be vulcanized.

The vulcanizing process is begun with steam, of about $3\frac{8}{10}$ths atmospheres, and this is continued for about one hour, when steam of about $4\frac{8}{10}$ths atmospheres is gradually employed; the whole process occupying about five hours and twenty minutes, being about two hours less than the usual time.

In order to prevent moulded articles from losing their form when under the vulcanizing process, it is proposed to place them in boxes, with alternate layers of articles and pipeclay, or very fine sand, until the box is full; the cover is then put on, and sackcloth placed over it, to prevent the condensed steam falling again on the box or case. The whole is then placed in the vulcanizing receptacle, and when the articles are withdrawn, they will be found unchanged in shape, and requiring only a little hand labor to make them fit for the market.

The second part of the invention relates to the use of moulds of hard india-rubber, in place of the expensive carved or cast metal moulds at present employed in the moulding of articles of india-rubber. The hard india-rubber moulds are made from plaster casts of the articles to be moulded in the usual way, but in two halves, for the greater convenience of moulding. A number of these moulds can be fitted into a frame, worked by a powerful press, the material to be moulded being cut into a suitable form before being placed in the moulds. By these means the cost of the process of moulding is greatly reduced, since the india-rubber moulds are inexpensive, and many articles can be moulded at the same time, thus effecting a saving of time and labor.

To HENRY WILLIS, *of Manchester-street, Gray's-inn-road, for improvements in organs.*—[Dated 9th February, 1857.]

THE object of this invention is to increase the mechanical facilities for producing a *crescendo* and *diminuendo* upon the organ, by enabling the player to draw or shut off any required number of the stops, one after the other in succession, by one continuous movement, in contradistinction to the complex operations, at present demanded of the performer to produce the like effects.

The figure in Plate XII., is a side elevation, partly in section, of the arrangement of mechanism for carrying out the principle of this invention; a portion of the wind chest being removed to shew the internal construction. In this arrangement it will be seen that but one barrel is employed, but in some cases it may be desirable to use two barrels; one for actuating the levers which effect the shutting off of the stops, and the other for operating the levers through the intervention of which the stops are drawn. *a, a*, is a barrel, mounted in suitable bearings, and carrying on its surface a double set of pins, which are set in helical lines around its periphery, and are intended to act upon bell-crank levers *b, c*, suspended above the barrel, and connected respectively by rods, with rock levers *d, d*, properly centered on a beam or frame that carries the pneumatic lever wind chest. Rods from these levers *d*, pass through the wind chest *e, e*, to the valves *f*, which close the air passages *g*, leading to the pneumatic lever bellows *h*. These bellows are arranged in two ranks above the wind chest, and they are connected in pairs to their respective slides or draw-rods *i, i*, so that the inflation of the one, coupled with the consequent contraction of the other, will permit of a backward or forward motion being imparted to the slide, in order to draw or shut off the stop as required. It will now be understood that, if the number of levers *d*, in connection with pneumatic lever bellows, correspond to the number of stops to be governed by this apparatus, and the same are set in action in due order, by the rotation of the barrel *a*, the stops may all be drawn in succession, so as to produce a *crescendo* or increasing power of sound; and in like manner the opposite effect may be produced by the direction of rotation of the barrel being reversed, as will be presently explained. On the axle of the barrel is a pinion *k*, which gears into a sector rack *l*, connected by a rod *m*, with a pedal lever, or a knob, that yields to pressure, or other contrivance placed within reach of the performer. The depression, therefore, or elevation of the pedal lever will cause the sector rack to rock on its fulcrum, and thereby impart an axial motion to the barrel. It has been stated that the barrel is provided with two sets of pins; these are intended, the one set to act upon the bell-crank levers *b*, and shut off the stops, and the others on the levers *c*, and draw the slides. The rock levers *d*, are connected alternately, the one with a lever *b*, and the next with a lever *c*, and so on, throughout the series. To the lower ends of the rock levers tumbling pieces are fitted, so that the pins which are intended respectively to operate those levers when moving in one direction will, when the rotation of the barrel is reversed, slip past the tumbling pieces without moving the levers. In large organs, where the number of stops to be thrown in and out of action is numerous, it may be found convenient to give the barrel a slight endway motion, in order that the barrel, in completing a revolution, may not present those pins which have already performed their action again into contact with

their respective levers, until the action of the apparatus has been reversed. To this end, a screw-thread is turned on one end of the barrel axle, and the bearing is tapped to correspond thereto. The continued rotation of the barrel will thus ensure its receiving a slight endway motion, sufficient for the pins that have acted to pass on one side of the levers. When this arrangement is adopted, the pins must be set a proportionate distance apart, to ensure their meeting the ends of the bell-crank levers at the proper time. It will be understood that the order of succession of throwing out and bring into action the several stops will depend upon the judgment of the organ-builder, but the amount of *crescendo* and *diminuendo* may be governed by the taste of the performer. Thus a complete depression of the pedal or other contrivance will produce a full *crescendo,* by bringing all the stops into action, one after the other; and by relieving the pedal or other machinery from the pressure or force which has influenced it (which may be effected by depressing another pedal, or equivalent mechanical contrivance), the stops will be gradually, and in succession, withdrawn out of action, and a *diminuendo* will take place. But when a *crescendo* or *diminuendo* of limited extent is desired, that may be produced by depressing, more or less, the pedal lever, or other contrivance which imparts the rotary motion to the barrel *a.* In order to give the barrel a tendency to take a neutral position when not in action, that is, to stand with the pins free of, or not in contact with, the bell-crank levers, a stop-wheel is mounted on its axle, with an undulating or notched periphery, and an anti-friction bowl *n,* carried by a spring lever *o,* is caused to bear against that wheel. The pressure of the bowl will therefore be greatest when in a raised position, and resting then on an inclined plane, it will tend to move the barrel round to the neutral position required. This is most suitable for a movement actuated by two pedals, the one rising as the other falls, but will scarcely be necessary when but one pedal is used, in which case a spring, attached to a band passing round an unoccupied part of the barrel, will cause the pedal to rise and effect a *diminuendo;* but convenient notches will then be applied for fixing the pedal at one of several points of its traverse action, in which case its movement to those points will always ensure a certain power of sound. Connected to the hinder end of the levers *d,* is an arrangement for holding or retaining those levers in check a sufficient time to allow the bellows which draw or shut off the stops to become thoroughly inflated, before they return to their normal position, and cut off the supply of wind. The principle of action of this retarding movement is to render available the pressure of the atmosphere for counteracting the tendency of the lever to return to its normal or quiescent position, by causing the lever, whose movement is to be governed, to collapse (during its active movements) a small air chamber, which is capable of filling again, but slowly, when released from the pressure of the lever. *p,* is a cylinder, fitted with a piston *q,* which is attached to the lever *d.* The upper end of the cylinder is covered by a valve opening outwards, in which a small opening is made. The air having been expelled by the thrust of the piston of the lever *d,* from the cylinder, is only re-admitted through a small aperture in the valve, and as the cylinder requires a certain time to become inflated, a retardation is consequently effected: the like result may also be attained by means of a bellows. This retarding action may also be applied with advantage in other parts of the organ, for instance, in the pedals of this movement. To facilitate the action in all weathers of the above de-

scribed *crescendo* and *diminuendo* arrangement, it is proposed to insert between the head of the screws *r*, which connect the upper boards *s*, to the wind chests that supply the pipes with wind, washers of india-rubber or other elastic material, which, possessing the property of yielding slightly, will allow the slide to move comparatively freely, even in damp weather.

The above-described invention is not intended to supersede the use of the ordinary appliances for drawing and shutting off the stops, either singly or in groups, but simply as an addition to organs, to produce musical effects which have hitherto been but very imperfectly realised upon that instrument.

The patentee claims, "First,—drawing or shutting off the stops of organs by a continuous movement, in contradistinction to intermittent or repetition movements, whether such mechanical result, and the novel musical effect thereby produced, be obtained by the mechanism above described, or any mere modification thereof. And, secondly,—the mode of retarding the return movement of levers in organs, as above explained."

To Henry Whittles *and* Robert Schofield, *both of Rochdale, for improvements in the construction of the slide-valves of steam-engines, and in the mode of working the same, for the better regulation of the vacuum in the cylinders thereof, economizing fuel, and for ensuring safety and steadiness of such machines whilst in action.*—[Dated 31st January, 1857.]

This invention relates to the slide-valves of steam-engines, and consists in combining a second or auxiliary slide, or D cutter, with the ordinary D slide employed for covering and uncovering the ports or openings through which the steam alternately enters and leaves the cylinder during the working of the engine, and in adjusting and actuating such auxiliary slide, as hereinafter stated. An important feature in the improved mode of constructing and working the slide-valves of engines, consists in the facility it affords for cutting off the steam, entirely or partially, at any part of the piston's stroke, or of altering or adjusting the cutter-valve during the working of the engine, so as to use the steam more or less expansively therein; and further, in so arranging such slide-valves, that both sides of the piston cannot be open at the same time to the vacuum, when the crank is passing its centres, as is commonly the case with the slide-valves of steam-engines, and by which they work by jerks; whereas, by these improvements, the motion of the piston and crank will always be regular and uniform, and the wear and tear of the mechanism connected therewith be very much lessened.

The figure in Plate XII., is a transverse and vertical section of a cylinder and D valves, shewing the adaptation of the improved auxiliary slide or cutter attached thereto. The valves are shewn as admitting the steam to the top of the piston, the valves being in the up-stroke, which, on being completed, and their motion reversed, the under or cutting-off side of the valve *b*, will come in contact with the adjustable auxiliary slide *a*, (which works in stuffing-boxes, and depends entirely on the D valves for its motion); this, closing the top port, and carrying the auxiliary slide along with it, allows the bottom port to open only as far as the top one. These

auxiliary slides *a, a*, regulate the quantity of steam admitted into the cylinder, by varying the distance between the cutting-off sides of the slides and the ports. This variation may be effected by the right and left-handed screws *c, d*, working into the collar *f*, on which is a worm-wheel, driven by the worm *g*,—motion being imparted thereto by hand, or by suitable mechanism attached to the governor of the engine, thus regulating the quantity of steam admitted into the cylinder with certainty and ease.

The patentees claim, "the combining of the auxiliary and adjustable slides or cutters *a, a, a*, with the ordinary D valves of steam-engines, as above described and represented, or any mere modification thereof, for the purpose of regulating the quantity of steam admitted into the cylinder, thereby allowing the steam to be worked more or less expansively therein, according to the power required."

To Thomas Richardson *and* Edmund John Jasper Browell, *of Neville Hall, Newcastle-on-Tyne, for improvements in treating old or waste railway wood sleepers and bearers, and in preparing or preserving wood for railway sleepers and bearers, and other works.*—[Dated 13th April, 1857.]

This invention has for its object improvements in treating old or waste railway wood sleepers and bearers, and in preparing or preserving wood for railway sleepers and bearers, and other works.

In the construction of railways, much wood is employed for sleepers and bearers of the rails, such wood being in a large proportion of cases prepared by tar, or products obtained by distillation from tar. Now part of the invention consists in subjecting the old or waste sleepers or bearers to the process of dry distillation, to obtain tar or products therefrom, suitable for preparing other wood for railway sleepers and bearers, and other works. And the improvements also consist in combining with tar, used for preparing or preserving wood for railway sleepers and bearers, and other works, a chemical solvent, such as caustic soda solution.

In order to obtain tar and other products from old or waste railway sleepers or bearers, the patentees proceed as follows:—All adhering dirt or other foreign matters are removed from the old or waste railway wood sleepers or bearers, before subjecting them to distillation. This waste timber may be used whole, or it may be first cut into small faggots, and it is preferred that it should be air dried for some time previous to distillation. The clean and dry old and waste timber, either whole or cut into smaller blocks, is submitted to dry distillation, and for this purpose the patentees prefer to employ the arrangements and apparatus now in common use for making coal gas; and they wash the gas thus generated with a weak solution of soda, before passing it into the lime purifiers. This gas, which is obtained in addition to the tar and other products, is suitable for use for illuminating purposes.

The retorts are heated up to a cherry or bright red heat, and it is found that the higher the temperature, the better for general purposes. Each retort is charged with about 1 cwt. of the timber, prepared as above described. The distillation should be driven as rapidly as possible, and the charge worked off in from two to three hours, according to the kind and state of the timber. The charcoal is withdrawn, and the fire extinguished by water or charcoal

powder. The gaseous products require more lime for purification than coal gas, but they possess the great advantage of being free from sulphur compounds, and may be used either alone or mixed with ordinary coal gas. The liquid products of the distillation, which are arrested in the hydraulic main, principally consist of the tar and acetic acid, and these may be separated and treated in the usual manner, in which case, the tar, when distilled, will furnish the compound known under the name of dead oil, which may be employed at once for the preservation of new sleepers and bearers in the ordinary manner.

But instead of distilling the tar for the purposes of obtaining the dead oil, the patentees prefer, according to the second part of their invention, to mix one of the following saline solutions with it, in about equal volumes, viz., a solution of caustic soda, of about 1·13 specific gravity, or the liquor known in the alkali trade under the term of red liquor, with a specific gravity of about 1·30. These mixed fluids they heat to a temperature of from 90° to 100° Fahr., and force this warm solution into the cylinder containing the timber, with the usual precautions. By mixing the tar with these solvents, it is rendered perfectly fluid, and suitable for use in preserving timber, whereas, heretofore, in order to obtain a preserving liquid of sufficient fluidity to be successfully employed for this purpose, it has been necessary to distil the tar, and so separate it from its bodies, which, although they have considerable preservative properties, render the tar too thick for use. Or, instead of separating the acetic acid portion of the liquid products, when the acetic acid is present in comparatively small quantities, the patentees neutralize the acid by means of carbonate of soda, or otherwise, and they dissolve in 1 gallon of the liquid, about 1 lb. of caustic soda, or 2 lbs. of red liquor salt, and mix it gallon for gallon with the tar, warming up the mixed liquids to about 90° to 100° Fahr., and proceeding as before. In this way, the proportion of preserving material, which would otherwise be lost in the acetic acid liquid, is rendered useful.

In all these different methods, the temperature may be varied considerably, without affecting the result, and when it is not an object to collect the gas in distilling the waste timber, a lower heat and slower distillation will increase the production of the liquid products.

The patentees remark that, when sleepers or bearers are distilled which have originally been submitted to the creosoting process, they obtain, in addition to, and mixed with, the tar formed by the distillation of the wood, the dead oil originally used in its preparation.

The patentees do not confine themselves to the exact details described; but they claim, "First,—the distilling old or waste railway sleepers or bearers, to obtain tar or products therefrom, suitable for preparing other wood for railway sleepers or bearers, and other works. And, second,—the combining with tar used for preparing or preserving wood for railway sleepers and bearers, and other works, a chemical solvent, so as to render it sufficiently fluid to be used without separating some of the substances which it contains, by distillation."

To Richard Archibald Brooman, *of Fleet-street, for improvements in galvanic batteries, and in apparatus connected therewith,—being a communication.*—[Dated 10th January, 1857.]

This invention consists in constructing a battery, the positive and negative elements of which are made to move, or are put into motion, in the exciting fluid; or the fluid is itself agitated or disturbed while the positive and negative elements are stationary. The invention further consists in the arrangement of the battery, and the apparatus employed therein or in connection therewith.

When the elements are made moveable in the fluid, the battery may be arranged thus:—A number of positive and negative plates, in the shape of discs, of convenient form, with washers or blocks of india-rubber, gutta-percha, or other like material placed between every two plates, are fitted, in alternate order, in or round a wooden drum or frame; the positive plates being connected together by a threaded metal rod, and the negative by another and similar rod. Metallic connection is conveyed from all the positive or all the negative elements from one of these rods through a driving pulley, fitted at one end of the wooden drum, through the axis of the pulley, which forms three of the arms or axes on which the drum is supported, and is free to rotate, through the bearing in which the arm or axis is supported, to the positive or negative pole, as the case may be. All the opposite elements are united at the opposite end of the wooden drum through the other rod, which is connected to a plate on that end of the drum. The plate has a stud in the centre, which forms the axis for the drum at that end, and through which the current passes, and thence through the bearing in which the axis revolves, to the negative or positive pole, as the case may be. Rotary motion is communicated to the drum through a driving belt, passed over the pulley in the drum, which carries with it all the positive and negative elements. The drum and plates are enclosed in a case or trough, into which the exciting fluid is admitted, its flow being properly regulated. An overflow pipe, and discharge tap, are also fitted to the case. When the drum is placed vertically, the deposits are driven off by centrifugal action.

When the plates are to be stationary, and the exciting fluid disturbed, an instrument is employed for the purpose of agitating the fluid, or working it round, or to and fro, consisting of a comb or reed, or contrivance composed of a back piece, formed or fitted with teeth, corresponding to the spaces between the plates, made of india-rubber or other flexible material, which teeth rub against the surfaces of the plates and remove deposits formed thereon. A similar instrument, made stationary, may be employed to clean the plates when the latter are made to revolve. The plates may be so contrived that the negative and positive may revolve in contrary directions.

The motion or disturbance imparted to the negative plates prevents polarization, while that of the positive elements prevents formation of deposits on their surfaces. The rate of speed should be regulated according to the energy desired.

An intensity battery is formed in one trough, and in an exciting liquid common to all the elements, by connecting several positive and negative elements upon the drum in pairs. The end elements, in opposite ends of the drum, form the positive and negative poles.

For stirring or giving motion to the exciting fluids of batteries, the inventor sometimes substitutes for the apparatus before described, an apparatus which forces air into the said fluids.

The following is a description of an improved battery constructed according to this invention, and in which air is employed for the purpose before mentioned. Each cell of the battery is composed of plates of zinc, and of carbon, arranged alternately in a cell completely closed on all sides. The surface of the zinc plates may be half, one-third, or a fourth of the surface of the carbon. The whole of the plates of the same material are connected by a common conductor, which passes to the exterior of the cell, without coming in contact with the plates or conductor of the other set. These conductors are completely coated with some isolating or non-conducting material.

In Plate XII., fig. 1, represents a vertical section of a cell. In the bottom of the cell is placed a tube A, which communicates with the interior of the cell by means of a series of small vertical holes B, corresponding to the intervals between the plates. This tube A, communicates with another and outer flexible tube C, which, in its turn, communicates with a wind or blowing apparatus G. The upper part of the outer cell or box is pierced by two holes, one D, for the escape of air, the other E, which extends to the bottom of the cell, for the introduction of the exciting fluid. The lower part is pierced by a hole F, which extends to the top of the cell. This hole is for the escape of the exciting fluid. All these holes are wrought within the thickness of the side of the cell, so as not to take up any room in the inside of the cell. In order that the fluid may be renovated by a uniform influx of fresh fluid, it is necessary that the holes for the entrance and escape of the fluid should be placed at the opposite extremities of the cell. The exciting fluid, composed of water, acidulated to a convenient degree, and holding in solution or suspension bichromite of potassa, &c., or binoxide of manganese, or other similar substance, enters the cell by the tube E, and escapes by overflowing through the tube F. When the fluid has entered the cell, the wind or blowing apparatus is set going, and the air forced in through the tube A, and the small vertical holes B, sets the fluid in violent agitation, which, as well as the flow of the fluid itself, must be maintained as long as the battery is kept in action. The fluid which escapes from the battery is collected in a vessel prepared for the purpose, and is allowed to cool: it may, however, be used again, if not saturated with soluble salts; but when its powers of solution are exhausted, it is subjected to evaporation, in order that its contents may be obtained. When the battery is put out of action, the tube G, and, by consequence, the flexible tube C, is lowered, and the whole of the fluid is allowed to escape through the air-holes. To wash the apparatus, the same process is adopted, but with water only. To examine the state of the plates, the piece K, which is a fluid-tight piece of leather, or india-rubber, or other suitable material, is removed, and the whole of the plates may be withdrawn, as they are all connected on a rack for that purpose. To compose a battery of a number of cells, the cells are placed one upon the other, but in such a way that the escape orifice F, of each cell which is added shall correspond exactly with the entrance orifice E, of the cell next below it. A tension battery may also be made by placing the cells side by side on the same horizontal plane, as in figs. 2, and 3.

In either of these last arrangements, the flexible air-tubes C, of the

several cells, all unite in a general air-tube G, so that one apparatus serves to force the air into the whole of the cells, and the whole battery is emptied at one orifice H. The two operations, of the forced introduction of air, and the constant renovation of the exciting fluid, are equally necessary to the preservation of the uniform energy of the galvanic current. If one of the two processes be adopted without the other, the result is incomplete, and the apparatus is not capable of uniform or lasting service. If the flow of the fluid be stopped, there results a considerable increase of temperature, a rapid decomposition, a plentiful deposition on the surface of the plates, a useless corrosion of the zinc, and a decrease in the power of the current. Again, if the air process be arrested, the current is weakened. Of this the experimenter may assure himself, by introducing into the circuit a small piece of platinum wire, which assumes successively a red and a white heat while the blast is kept up, but when the blast is discontinued, the incandescence of the platinum disappears: the incandescence is, however, resumed by the wire, directly the air apparatus is again set in motion. It is also indispensable to employ a fluid composed as already described, for with water simply acidulated with sulphuric acid, no advantage is obtained from the air process; but, using all the means and precautions hereinbefore described, there is no limit to the power of the battery, except its dimensions. The manipulation of this battery is very simple, and the number of cells may be increased to any extent, without rendering the battery at all complicated. It exhales no noxious odour; it is put into or out of operation in an instant; and, with equal surface, it gives more "quantity" than the battery of Bunsen.

The patentee claims, "First,—the construction of galvanic batteries in which the metallic or other elements are put into motion in the exciting fluids, or in which the excitingfluids the mselves are put in motion; both for the purpose of facilitating the action of the fluids upon the elements. Secondly,—the application, for the said purpose, of jets or currents of air to the fluids of galvanic batteries, as hereinbefore described. Thirdly,—the method of preserving the constancy of galvanic batteries by causing fresh supplies of the exciting fluid to flow continuously into the cells, as hereinbefore described. Fourthly,—combining with the improvements comprised in the three preceding claims, the employment, as an exciting fluid, of acidulated water, containing bichromate of potassa, or binoxide of manganese, or other similar substance, in the manner and for the purpose hereinbefore described. Fifthly,—the construction of galvanic batteries and apparatus connected therewith, as hereinbefore described, and represented in the drawings hereunto annexed."

To WILLIAM HENRY BARLOW, *of Derby, and* HENRY WOODHOUSE, *of Parliament-street, London, for improvements in the permanent way of railways.*—[Dated 20th January, 1857.]

THIS invention consists in a method of attaching rails to their sleepers, for which purpose clamps of metal are employed, which have their ends turned inwards, so as to embrace the sleeper, and pass over and clip the bottom flange of the rail. These side clamps are secured to the sleeper by a bolt passing through the clamps and the sleeper, or otherwise. To support the ends of railway rails, when such ends are "fished," two one-

jaw chairs are employed, one placed at each end of the fish-plates, and the rails and fish-plates are fastened to the jaw of the chair by means of bolts passing through them. If flat-bottomed rails are used without chairs, the fish-plates are lengthened, so as to allow them to rest at each end over the sleepers; or the sleepers are placed closer together, with the same object. When transverse sleepers of cast-iron are used, such sleepers are made in halves or portions, which are coupled or bolted together between the lines of rails; and when using railway-chairs with transverse sleepers, the under parts of the chairs are formed with projecting plates attached thereto, and turning downwards, so as to form a saddle, and fit over the sleeper, thus protecting it from damage by the plate-layers' tools, and extending the bearing surface of the chair on the sleeper: the projecting plates may be further extended to bear on the ballast, and when this is done, the size of the sleeper may be diminished.

The ordinary method of holding the fish-plates to the rails, to make a fish-joint, is by means of bolts passing through them and through the rails, and these bolts are very liable to become loose. Now, by this invention, the fish-plates are bolted to the chairs in place of the rails, and chairs having a V-formed opening are employed; through this chair the rail and fish-plates pass. The fish-plates are formed with inclines at the back, so as to correspond with the inclines inside the chair; and bolts pass vertically through the backs of the fish-plates, to the under part of the chair. It will be seen that as these bolts are screwed up, the inclines act to press the fish-plate against the rails.

In Plate XII., fig. 1, is a transverse section of a railway sleeper, having a rail attached to it by metal clamps, arranged according to the first part of this invention. *a*, is the rail, and *b*, the sleeper, to which it is attached by the clamps *c*, *c*, arranged so as to embrace the sleeper, and pass over and clamp the bottom flange of the rail down to the blocks of wood *d*, *d*, which fit into the recesses of the sleeper. *e*, is a bolt to draw up the clamps; it passes through the two clamps, and through the sleeper.

Fig. 2, is a side view, and fig. 3, is a transverse section of a fished joint, supported by two one-jawed chairs, one placed at each end of the fish-plate, and having the rails and the fish-plates fastened to their jaws, by bolts passing through them, according to another part of this invention. *a*, *a*, are the ends of the rails; *b*, *b*, the fish-plates; and *c*, *c*, the two one-jawed chairs. *d*, *d*, are bolts, each passing through the two fish-plates and through the end of one of the rails. *e*, *e*, are bolts, which each pass through the bolts of one of the chairs, and also through the end of one of the rails and the fish-plates.

According to another part of this invention, flat-bottomed rails may be connected together by fish-plates, made of sufficient length to rest at each end over the sleepers. The fish-plates are of more than the ordinary length, but fish-plates of the ordinary length may be employed if the sleepers be put closer together.

Fig. 4, is a side view, partly in section, and fig. 5, is a plan, of a transverse sleeper of cast-iron, made in halves or portions, which are coupled or bolted together between the lines of rails, according to the next part of this invention. *a*, and *b*, are the two parts of a sleeper; the part *a*, has at its end (which comes midway between the rails) a fork formed, and the

piece *b*, has a tongue, which fits between the prongs of the fork on the piece *a*. Through the prongs of the fork, and through the tongue, three ranges of holes are drilled, to receive a bolt *c*, and the holes are so arranged that, by shifting the bolt *c*, from one range of holes to another, the length of the sleeper can be to some extent altered, so as to adjust it to the gauge of the railway. The sleeper shewn carries two joint chairs, and the way in which the ends of the rails are fixed in those chairs, constitutes another part of the invention, to be presently described.

Fig. 6, is a side view, and fig. 7, a front view, of a railway chair, arranged according to another part of this invention, and having projecting plates attached to its under side, which turn downwards, so as to form a saddle to fit over the transverse sleeper, and protect it from damage by the plate-layers' tools: these projecting plates are so far extended as to bear on the ballast as well as on the sleeper. *a*, is the railway rail; *b*, is the transverse sleeper; and *c*, is the chair, the upper part of which is of an ordinary description; and c^1, c^1, are the projecting plates before mentioned. *d*, *d*, are trenails by which the chair is fixed on the sleeper.

Fig. 8, is a side view, partly in section, of another railway chair, arranged according to this invention, but differing somewhat in form from that just described.

Fig. 9, is a transverse section of a chair supporting a fish-joint, made according to the last part of the invention, by bolting the fish-plates to the chair, in place of to the rail. *a*, *a*, are the ends of the rails; *b*, is the chair, having a V-formed opening through it; *c*, *c*, are fish-plates formed with inclines at the back, so as to correspond with the inclines inside the chair; *d*, *d*, are bolts, which pass vertically through the backs of the fish-plates, to the under part of the chair.

To François Frederic Dumarchey, Samuel Levy, *and* Joseph Mayer, *all of Paris, for improvements in wheels and axles for common road carriages.*—[Dated 6th January, 1857.]

This invention relates to a certain mode of applying axles to carriages, and consists in fixing the wheels of ordinary carriages to the axletree, thus making the axletree and the two wheels turn simultaneously.

Another part of the invention relates to a novel construction of the wheels of carriages, by which they are allowed the better to run over the road.

In Plate XII., fig. 1, shows an external longitudinal view of an axletree arranged according to this invention; fig. 2, is a longitudinal sectional view of another construction; and fig. 3, is a similar view of a third form of axletree, shewing one of the bearings in which the axletree has to turn; fig. 4, is a side view of one of the bearings; and fig. 5, is a transverse sectional view of the same. The axletree is formed of two parts *a*, and *b*; the one *a*, being provided with a projecting part *c*, fitting into a corresponding cavity *d*, made in the end of the part *b*: the axletree may have a cylindrical or any other suitable form, and the wheels are fixed or keyed in any suitable manner on the axletree, so as to form one body with the same; each wheel being thus obliged to follow the revolving motion of

that half of the axletree to which the same is attached. The projecting part *c*, having been inserted in the cavity *d*, the coupling of both axles is completed by pushing the boss *e*, over both parts, so as to keep the two half axletrees or axles connected together; or this boss may be dispensed with, and instead of it a suitable enlargement given to the parts *c*, and *h*, in the manner shewn in fig. 3. It will be understood that, in this arrangement, the part *c*, is allowed to turn freely in the cavity *d*, and that consequently each of the two halves of the axletree may rotate with a different velocity, and, if required, in opposite directions, thus allowing the two wheels of one axletree to revolve with different speeds and in opposite directions, which will be found particularly useful when the carriage to which this arrangement is applied has to turn round a corner, or otherwise follow a curved direction. Each of the parts *a*, and *b*, is furnished with a collar or ring *f*, of a conical form, and which is solidly secured to such axles: the rings are inserted, and turn in suitable metal bearings or boxes *g*, having in the interior a part g^1, of brass or other suitable metal, against which the rings *f*, exert their pressure and friction, when revolving. The said bearings *g*, are fixed to the under side of the carriage frame in any suitable position, and by any suitable means.

The second part of the invention, relating to the construction of wheels, consists in having a light, but very solid, circular frame round the wheels, and forming a sort of moveable rail between the wheels and the ground over which the wheels have to run. Round the nave of each wheel is fitted a collar, the outer rim of which is hollow, and forms a groove, in which fits and turns a ring furnished with a suitable number of projecting arms, in a manner similar to the spokes of a wheel; and over the ends of these arms is fixed a broad hoop or tyre, of sufficient width to extend over the tyre of the wheel of the carriage, and thus interpose itself between the tyre and the ground over which the carriage has to run. The inner surface of the hoop is provided with a projecting rim, against which glides the flange with which the tyre of the wheel is provided; the hoop serving consequently as a circular revolving rail, which is constantly kept interposed between the wheel of the carriage and the ground.

The patentees claim, Firstly,—"the construction of the axletrees, as has been described, and the mode of applying the same to carriages other than railway carriages. Secondly,—the construction of wheels, provided with a revolving hoop forming a moveable rail, kept constantly between the wheel and the surface of the earth over which the carriage is to run."

To Charles Frederic Vasserot, *of Essex-street, Strand, for an improved gasogene.*—[Dated 23rd January, 1857.]

This invention consists of a vessel made of glass, china, or other ware, having a partition piece extending from top to bottom of the vessel, so as to divide it into two compartments. The pouring lip is so formed that it opens into the two compartments, so that, on pouring the liquid from the vessel, the solutions mix and form an aerated beverage. In one compartment of the vessel the acid is placed, and in the other the soda or other preparation; the two compartments are then filled with water or

other liquid, so as to dissolve the powders. By pouring the liquid from the apparatus, the two solutions will mingle as they enter the glass, and will form an aerated beverage.

To Louis Etienne Deplanque, *of Paris, for an improved composition for sharpening and setting fine-edged cutting instruments.*—[Dated the 28th March, 1857.]

This invention consists in the combination of certain vegetable and mineral substances with vulcanised caoutchouc, for the production of a material applicable to the setting and polishing of razors and other fine-edged cutting instruments.

The following are the agents, and the proportions in which they are incorporated with the vulcanized caoutchouc, to form a material suitable for replacing strops and razor-paste:—

No. 1.—Caoutchouc, two pounds, three ounces; emery, eight pounds, twelve ounces; smoke-black, six and one-third drachms.

No. 2.—Caoutchouc, two pounds, three ounces; plumbago, four pounds, six ounces; smoke-black, six and one-third drachms.

No. 3.—Caoutchouc, two pounds, three ounces; vegetable charcoal, three pounds, thirteen ounces; smoke-black, six snd one-third drachms.

No. 4.—Caoutchouc, two pounds, three ounces; zinc-white, eight pounds, twelve ounces; yellow-ochre, seven ounces.

To the above compositions red-ochre and pumicestone may be added with advantage.

To prepare a material suitable for polishing,—take of caoutchouc, two pounds, three ounces; sulphur, ten and a half ounces; emery, eight pounds, twelve ounces.

To prepare a material for setting and polishing, as a substitute for millstones and polishing stones,—take caoutchouc, two pounds, three ounces; sulphur, one pound, one ounce; emery, ten pounds.

Pumicestone, marble, silex, millstone, brick, and other mineral substances, suitable for sharpening and polishing knives and other fine-edged cutlery, reduced to powder, and passed through a sieve, may be employed with the caoutchouc in the proportions hereinbefore stated for the sulphur and emery.

The above-named substances, reduced to powder, and sifted, are mixed with vulcanized caoutchouc by the ordinary processes, and the composition is then moulded and otherwise formed into the desired shapes.

The patentee claims, "the combination of vulcanized caoutchouc with vegetable and mineral substances for the production of a material or composition for sharpening and setting fine-edged cutting instruments, as hereinbefore described."

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

November 10th, 1857.

ROBERT STEPHENSON, Esq., M.P., President,—in the Chair.

The first meeting of the session 1857-58 was occupied by reading a paper "*On lighting mines by gas,*" by Mr. Alexander Wright, Assoc. Inst. C.E.

This paper commenced by noticing the almost universal introduction of gas for the purpose of illumination, and the causes of the attention of the author being turned to its adaptation to the lighting of mines, where the present mode of employing tallow candles, or oil lamps, was found to be prejudicial to the health of the miners, whilst the light afforded was so inadequate, that the men could not perform their duty properly. It was stated, that the expenditure of oil and tallow in the mines of England might be roughly estimated at £500,000 per annum.

In Cornwall and Devon alone there were about thirty thousand men employed underground, who were lighted at an annual expense of £90,000 per annum; and in one of the large mines the annual expenditure for candles had reached as high as £7000.

A general review of the state of lighting and ventilation of the Cornish mines induced the attention of the author to the introduction of gas, for superseding candles and oil lamps. An attempt had been previously made at the Tresevean mine, in Gwennap, but it was abandoned. He concurred that it was preferable to make the trial upon a mine where explosive gases were not given off, as in coal mines; and where the work was closer, and did not extend so rapidly.

The Cornish mines varied in depth from 1000 to 2000 feet, with extensive lateral galleries, the approach to which was by a shaft with ladders, sometimes twisted in all directions. Each miner, in descending or in ascending, stuck his candle in a lump of clay, by which it adhered to his hat; the wind caused it to flare, and not only to waste much tallow, but to give off carbonaceous substances, which were swallowed by the men, and produced very prejudicial effects on their lungs. The first object then was to light the ladders, and afterwards to extend the system to the working chambers following the lode. The mine selected for the experiment was the Balleswidden mine; the depth of the shaft was described as being about 780 feet, whence there branched out several levels and tramways, at various depths, and in numerous directions. About three hundred and forty miners were employed underground, in two changes or shifts, each of about eight hours' duration. Each man worked about five days during the week underground, and one day above ground.

In the ordinary mode of lighting, each miner burned four candles in eight hours, obtaining only an inadequate light for the expense incurred.

The gas which was introduced to this mine was manufactured at the surface, and was forced by a pump into a heavy gas-holder, composed of cast-iron plates, whence it issued, by a descending pipe, into the mine, under a pressure equal to 18·7 inches of water. The shaft and levels were fitted with wrought-iron tubes, proved by high-pressure steam, and

from the branches flexible tubes and burners were carried into the pitches and chambers for the miners, and to the floors for picking the ore. The tramways also had a sufficient number of burners, to preclude the necessity for using any candles or lamps in the mine.

The quantity of gas consumed was about 4000 cubic feet per day, of two shifts of miners.

The comparative expense of the two systems of lighting was stated to be much in favour of gas: as the annual cost of candles was £834. 3*s*. 4*d*., whereas that of gas was £487. 2*s*., including interest on plant, wear and tear, and all expenses.

If several mines combined, the economy would be still greater; and when the system became more general, modifications would doubtless be advantageously introduced.

It was stated that the sanitary condition of the mine was visibly improved; the ventilation was better, and there was an entire absence of the sickening smoke and bad odour, previously pervading the mine, which the author believed to arise from some particular compounds of hydrogen and carbon, given off during the imperfect combustion of the candles.

The advantages to be derived from the introduction of gas to copper, tin, lead, and other mines, and probably ultimately to coal mines, were stated to be:—1. A saving of nearly 50 per cent. of the annual cost. 2. The better work, on account of the increased light. 3. A saving in time to the workman, in not having the candle, or lamp, to attend to. 4. The improvement in the ventilation, and in the quality of the air breathed by the miners.

The experiment was stated to have been completely successful, and there did not appear to be any reason why the system should not be extended to mines generally, and, under certain precautionary measures, to coal mines.

Signor De Christoforis' apparatus for ascending inclined planes of Railways.

After the meeting, Signor De Christoforis exhibited and explained an apparatus proposed for aiding in the ascent of steep inclines. The system consisted in attaching to the periphery of the driving-wheels of the engine a number of small wheels, which, abutting against a series of cogs connected with the rails, it was assumed would constantly support the train in its ascent.

November 17, 1857.

JOSEPH LOCKE, Esq., M.P., Vice-President,—in the Chair.

The paper read was, "*On the conversion of wood by machinery,*" by Mr. G. L. Molesworth, Assoc. Inst. C.E.

In briefly glancing at the history of wood conversion, the author noticed the early application of machinery for the purpose, and also the introduction of the circular saw, the planing machine, and the band saw. The inventions of Bentham and Brunel were mentioned as having contributed largely to the advance of this branch of engineering.

A comparison was then drawn, shewing the more rapid progress of wood conversion in America than in England. This was ascribed to the

greater cheapness of material and the scarcity of skilled labour in the former country, which gave a stimulus to invention; whilst in England the case was different,—the material was comparatively expensive, and skilled artizans were abundant. Nor was the system of the subdivision of labour as yet fully carried out—the conversion of wood being hitherto in the hands of a class who could not employ much capital in machinery, or keep it constantly at work to the greatest advantage, even when they had it; and, at the same time, the prejudices of foremen, and the combinations of workmen, had operated powerfully against the introduction of new machines. Many of the machines of English construction had been of too costly a character, and in designing them, sufficient attention had not been given to economy of the converted material. The cheap and simple character of the American machines was mentioned, and some of their characteristic details were described.

An account of the different kinds of saws, as well as the form of teeth, the modes of setting them, and the velocities adopted in England and in America, was given, and the silent-friction feed, the American "muley" saw, the author's arrangement of a revolving wedge, the methods of cross cutting, the pendulous saw, Macdowall's circular saw, the pendulum, the dished saw, the scroll and the band saws, were briefly described, and mention was made of Mr. Exall's improvements in the band saw.

The author then proceeded to enumerate the varieties of planing machines, which he classified under five heads, viz.:—

(1). The reciprocating plane.
(2). The fixed cutter plane.
(3). The rotary cutters, on Muir's principle.
(4). Ditto, with vertical axis, on Bramah's plan.
(5). The socket plane.

In describing these machines, the action of the carpenter's plane was compared with that of the machines, and some of the methods were mentioned by which its action had been attempted to be assimilated in the machines.

The planing machines were shortly described, as well as the different forms and speeds adopted in England and America.

It was argued that, in order to produce good work, the conditions to be fulfilled were a high velocity of cutters, not too rapid travel of work, a solid bed to cut against, the working parts well balanced, the bearings steady, and the angles of the cutters properly determined. The author condemned the usual empirical method of determining the angle of the cutters, and insisted upon the desirability of taking into consideration the nature of the material, as well as the character of the work, and the diameter of the cutters, in fixing upon the proper angle. He then stated those angles which he considered best for different kinds of woods and varieties of work.

Brief descriptions and diagrams, illustrative of the principles of the following processes and machines, were then given:—

1. The American shaping machine, with pattern and concentrical collar guide, for planing irregular work.

2. The different methods of tenoning with chisels, or with an assemblage of circular saws, or with the ordinary tenoning cutters.

3. The copying machine, for producing fac-similes of a cast-iron pattern of any irregular shape, by means of rotatory cutters, made to

recede or advance by the pattern, which revolves simultaneously with the work.

4. Hughes' spoke machine, with tubular cutter-shaft and moveable cutters, acted upon by a traversing pattern.

5. The railway key machine, invented by the author, for cutting the taper simultaneously on two sides of the key.

6. Steel's oar machine, as used at Chatham dockyard, for roughing out the oar with swiveling circular saws, and finishing it by a series of cutters, acted upon by a "feeler iron," so as to produce a varying form of blade and "loom."

7. The methods of dovetailing, on Wimshurst's plan, by a series of rotating cutters; and on Burley's plan, by a series of reciprocating chisels and circular saws.

8. The method adopted in America of forming the dovetail on the mitre.

The different boring tools were then noticed, and an account given of the modes of mortising, by giving motion to the chisel and reversing it, as well as the forms of mortising chisels, and the devices for clearing the mortise of chips.

The subject of timber bending was briefly mentioned, and a description given of Hookey's mode of bending ships' timbers; Meadows' patent for bending veneers into and around the sharp angles of mouldings; and Blanchard's method of bending all kinds of timber, by applying end pressure to it, while it was wound round a cam, of the desired shape.

In conclusion, the author considered that wood conversion was not fully developed in this country; and hoped that this Paper would direct the attention and ingenuity of engineers to the subject.

November 24, 1857.

ROBERT STEPHENSON, Esq., M.P., President,—in the Chair.

The proceedings were commenced by the reading of an appendix to Mr. G. L. Molesworth's paper, "*On the conversion of wood by machinery.*"

The manufacture of casks by machinery was cited as an example of a branch in which many failures had occurred, in consequence of the machines having been frequently designed, without a view to effecting economy of material, so that the waste of valuable wood was not counterbalanced by the saving of labour.

The best machines in use for performing the following processes in the manufacture of casks were briefly described:—

The process of cutting up the "blanks" into staves, either by circular or by reciprocating saws, and of converting, without waste, irregular and twisted blanks into staves, by the use of weighted rollers pressing the work against an adjustable fence in the saw-frame.—The cutting out "tonguers" and "doublets" by a travelling template, which determined the position of the fence; and the plan adopted at Her Majesty's Dockyard, at Deptford, for irregular blanks, tonguers, and doublets, as well as the American mode of cutting staves for dry casks.—The process of jointing by moving the stave through a curved path, in the direction of its length, against circular saws.—Robertson's mode of backing staves, by

passing them on a travelling platform under cutters; and Green's mode of passing them over a pair of cutters arranged on each side of a guide-collar, whilst the stave was pressed down by a heavy fluted feed roller.—The processes of "trussing," on Rosenborg's principle, by a series of radial forcing levers, actuated simultaneously by screws; and on Robertson's principle, by means of strong cones, into which the staves were forced by hydraulic pressure.—The plan of "crozing and chining," by turning the cask up on a vertical lathe, after trussing; or by passing each stave separately under cutters.—And the process of finishing the heads with an oval motion, to allow for shrinkage of the wood across the grain; thus completing the different processes in manufacturing casks.

Hamilton's machine for sawing curved ship timbers, was described as having an inner gate, and the blade so hung as to allow of a transverse as well as a swivelling motion, for curvilinear work; the log being so arranged as to be turned on its axis whilst travelling, and to be cut to any desired bevil. Green's method of adapting an indicator roller to this machine, for cutting variable bevils from a small scale diagram, was also mentioned.

The largest circular saws were stated to be those used for cutting veneers from the log; their size, velocity, and mode of action were given, as well as the attempt to supersede them by a revolving knife edge, with the causes of its failure. The Russian method of cutting veneers was briefly touched upon, as well as the reasons for its non-adoption in England; and the French method, with a reciprocating knife edge, was also described.

A description of Jordan's wood-carving machinery was given, with his method of producing a species of floating movement in the table carrying the pattern and the work, under a frame furnished with a series of drill cutters and a tracing knob, so as to produce several copies simultaneously from one pattern. The plan of carving under-cut parts by swivelling the pattern and work simultaneously, was also described.

The appendix concluded with an account of Messrs. Ransome and May's manufacture of compressed railway keys and trenails, and also of the mode adopted in Her Majesty's Dockyard, Portsmouth, of shaping trenails cleft from timber of irregular or twisted grain.

A description was given of Wilson's machinery at the Midland Counties Timber Company's Works at Banbury, for the conversion of wood into mop and broom handles, of which very large quantities were manufactured. Cylindrical gouge cutters were used, so that by turning them gradually in their sockets, they always presented a cutting edge, which would work for sixteen hours without sharpening, and a tool would last three months. The surface produced was excellent, and the machine was now about to be used for making pencils.

The carving machinery invented by Mr. Jordan, and used for the decorations of the New Palace at Westminster, was alluded to; and a description was given of the ingenious machines, also invented by him, for making the frames of school slates, at Colonel Pennant's Quarries, near Bangor. The logs of American birch were first cut up by frame saws; the planks were then seasoned for six months, and were afterwards cross cut to proper lengths,—passed over a series of circular saws and grooving cutters alternately fixed on the same shaft. The mortises and tenons were cut in two other machines; the end mortises, tenons, and shoulders were then cut, and the slates encircled by four of these pieces. The frame, thus formed, was then laid against two stops, and a

pair of drills descended upon the opposite corners, making two holes; it was then reversed, and another pair of holes were made in the other two corners; pegs were inserted, and the work was completed. Up to that point the result was excellent; but it had been found impossible entirely to finish the work with the delicacy with which the human hand could do it. In all such machinery, the vital importance of high speed and perfect balance were insisted upon; and many curious instances of failure, resulting from neglect of these points, were given.

Messrs. Ransome and May's trenail and key machines were further described; and the advantages of the pendulum saw for cross cutting, were strongly insisted on.

Green's stave-cutting machinery was explained, and the great quantity of work which could be executed by it, was shown.

Gibson's self-acting railway signals.

After the meeting, a model was exhibited of Gibson's self-acting signal and telegraph for railways. This apparatus was described as being intended to supply the want of a system of railway signalling, which should be efficient, and, whilst answering every purpose for which railway signals could be required, should be simple in construction, and not liable to be misunderstood or to get out of repair, being, at the same time, independent of the attention or the neglect of servants.

The apparatus consisted of a continuous arrangement of signalling, set in motion by the engine, which, in passing over a lever, placed closed withinside of the rail, in any desired situation, caused a signal-post (No. 1) to rotate partially, and so to indicate to the following train the close proximity of a preceding train. The signal-post No. 1, remained in this position until the engine arrived at the next signal-post (No. 2), the lever opposite to which, when depressed by the engine, caused it to rotate similarly to the signal-post (No. 1) previously passed, which was at the same time replaced in its original position. The engine then reached signal-post No. 3, and it and No. 2 would be simultaneously acted upon as were Nos. 1 and 2. Then No. 4 received the responsibility, and released No. 3, and so on. It answered equally well by night and day, and the present signal-posts could be adapted to it.

By the same motion of the horizontal levers, audible or visible telegraphic communications could be made with any station or stations, either in advance or in arrear of the moving train, thus indicating, by the continual ringing of a bell, if necessary, the approach, departure, present position, or passage through a tunnel, or over any dangerous part of the line. On foggy or stormy nights, or where there were sharp curves, &c., this would be found very valuable.

Another important part of the system was the contrivance for the self-acting contraction and expansion of stretched wire, by means of which hand signals, etc. could be acted upon at a distance of 2000 yards,—being far beyond the present working distance; and the wire, both in summer and winter, would always be at the same degree of tension.

The whole apparatus was described as having been in efficient action for some time at Binn's Junction, on the North Eastern Railway, where thirty trains ran daily over it, to the perfect satisfaction of the engineers and the officers of the line.

INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 306.)

The following paper, by Mr. MICHAEL SCOTT, of London, and Mr. ANDREW JOHN ROBERTSON, of Blyth, was then read:—"*On the theory of pile driving,—with description of an improved steam pile driving machine.*"

Theory of pile driving.—The subject of pile driving has been investigated by Dr. Whewell,* on principles first laid down by the present Astronomer Royal; but unfortunately the mathematical expressions which contain the result are so complicated, that although the distance a pile will be driven may be ascertained, provided the data be correct, by the substitution of numerical values in the different equations, still the process is tedious, and the result unsatisfactory. For the object of such investigations is not to determine to a fraction of an inch the distance a pile will be driven, more especially as the resistance offered by the ground, which forms the most important element in the calculation, can never be accurately ascertained; but the object is to elicit those simple and general truths upon which the system depends. By supposing the pile to be only just stirred by the blow, Dr. Whewell has simplified the equations to such an extent, as to deduce from them the following corollaries, which are arrived at by approximation; this approximation, however, holds good only when the quantities are so exceedingly small, that the first two terms of a series which does not converge may be assumed to express the value of the whole series.

The deductions are—

1st.—A slight increase in the hardness of the pile, or in the weight of the ram, will increase considerably the distance driven.

2nd.—The resistance being great, the lighter the pile, the faster it will be driven.

3rd.—The distance driven varies as the cube of the weight of the ram.

Although these results cannot be depended upon as exact under all circumstances, they still give a tolerably correct indication, and are in accordance with those which may be arrived at by general reasoning. The complication in the original expressions arises from taking into consideration, in the general question, the weight and inertia of the pile. The weight of the pile, however, bears so small a proportion to the resistance of the ground, that it may safely be neglected; for a 25 feet pile, 1 foot square, weighs about $\frac{1}{2}$ ton; and if the fall of a ram, weighing 1 ton, be 10 feet, and the distance driven by the blow be 2 inches, then the resistance offered by the ground, supposing the ram and pile to be perfectly hard, will be to the weight of the ram as 120 inches to 2 inches, that is, it will be 60 tons, of which $\frac{1}{2}$ ton is the $\frac{1}{120}$th part, and may therefore safely be neglected. But the inertia of the pile having to be compared with that of the ram is of more importance, the proportion in the case above supposed, being as 1 to 2. Although, therefore, the inertia of the pile be a matter of too much importance to be neglected, it may nevertheless be considered separately, to the great

* "Mechanics of Engineering."

simplification of the question involving the compressibility of the pile and ram.

If a body at rest be impinged upon by a body in motion, the two will, if inelastic, move on together; the momentum of the whole mass after impact, being the same as that of the impinging body before impact: if they be elastic, the momentum of the two bodies together is still the same, but the distribution is different. The two extremes of these conditions of things may be illustrated by a small hammer striking a pile or an anvil, and a sledge hammer striking a nail: in the first case, the hammer buries itself in the head of the pile, or rebounds from the anvil, without producing any further effect; in the second, the existence of the nail scarcely affects the motion or the blow of the sledge hammer. These two cases shew at once the great advantage of mass in the striking body, as compared with the mass of the body driven. In pile driving, the proportions between an ordinarily heavy hammer and a nail can never be approximated to; but we may conclude with safety that, within the limits imposed by practical considerations of convenience, and provided the material of the pile will stand the blow, the heavier the ram the more effective it will be.

Thus far the influence of mass has been considered only in overcoming the inertia of the pile: the same reasoning applies to shew that the heavier the ram, and consequently the greater its momentum, the greater is its power to overcome the resistance of the ground. So long as piling engines were worked by hand, any increase of weight of the ram beyond $\frac{1}{2}$ ton or $\frac{3}{4}$ ton, was seldom or never thought of; and the space for the application of the power of men being very limited, the motion was necessarily very slow. The introduction of steam has removed this difficulty, and in Nasmyth's steam pile engine, the weight of the ram was increased to $1\frac{1}{2}$ ton.

It remains to examine the effect of the height of fall of the ram, of which no mention has yet been made. The writers believe there has hitherto been a prevailing opinion that a rapid succession of blows from a moderately heavy ram, with a short fall, is more advantageous than with a high fall and proportionately diminished number of blows; for it is alleged, the pile never gets leave to come to rest,—this opinion, however, they consider to be erroneous.

Let H, be the height of fall; W, the weight of the ram; R, the resistance of the ground; and S, the space through which the pile is driven; then, neglecting the inertia of the pile, and supposing the ram and pile to be perfectly hard,

$$S = R \frac{WH}{R} \quad \ldots\ldots\ldots\ldots \quad (1)$$

But the ram and especially the pile are not perfectly hard; they are compressible and elastic, although imperfectly so. Let therefore A, and B, be the hardness of the ram and of the pile, then the space through which a nail is driven, that is a body whose inertia may be neglected, is

$$S = \frac{WH}{R} - \left(\frac{1}{A} + \frac{1}{B}\right)\frac{R}{2} \quad \ldots\ldots \quad (2)$$

as given in Whewell's work, before mentioned, to which reference is made for the steps of the present investigation. The last term in this equation is therefore the defect arising from imperfect hardness, and is

less as the hardness is greater, or as the joint compressibility of the ram and pile is less.

This equation leads to a result of great practical importance. For every position of the pile there is a certain value of the resistance R; and for this value of R, there is some value of H, the height of fall, which will make the second side of the equation (2) equal to zero. There is therefore a certain fall which will not drive the pile at all, however great the number of blows; the only effect produced being to soften the head of the pile by continual hammering, and consequently to make matters worse. This is not a theoretical case only: in driving the piles for the foundations of the piers of the High Level Bridge at Newcastle, it frequently happened that Nasmyth's steam pile driver hammered on the head of a pile for a considerable time without producing any other effect than softening the head of the pile, and making it necessary to cut it off several times. It must be observed, that this effect, or rather absence of effect, is due, not to the compressibility of the pile only, but to the total amount of yielding, from whatever cause arising. If the soil yields, the same result follows; and yielding of the soil is worse than any ordinary compressibility in the pile, because it is far greater in amount. This accounts for the difficulty of driving in sand, and for the rebound of the pile that has been often observed.

But although it may seldom happen that absolutely no effect is produced, a diminution of effect must always take place; and the important point to be noticed is, that for a given degree of hardness and given resistance, the *proportion* of loss is diminished by increasing the height of the fall. For supposing the fall required to compensate for the defect arising from imperfect hardness to be 2 feet, and the actual fall of the ram 4 feet, the loss is then one-half; but if the fall be 8 feet, the loss is only one-fourth. Now the power required to raise the ram 8 feet, is the same as to raise it twice to a height of 4 feet, in the same time; but the useful effect, in the first instance, is represented by $8 - 2 = 6$, and in the second by $2\ (4 - 2) = 4$; or for the same expenditure of power, the useful effect is half as much again with the higher fall.

Again, we have from the equation (2), when S, the space through which the pile is driven, equals zero,

$$\frac{\text{WH}}{\text{R}} = \left(\frac{1}{\text{A}} + \frac{1}{\text{B}}\right)\frac{\text{R}}{2}$$

$$\text{Whence H} = \frac{1}{2}\left(\frac{1}{\text{A}} + \frac{1}{\text{B}}\right)\frac{\text{R}^2}{\text{W}} \quad \ldots\ldots \quad (3)$$

or the height of fall, which represents the defect arising from imperfect hardness, varies as the square of the resistance, and, inversely, as the weight of the ram. Hence it appears that if the fall be kept constantly the same, as in the steam hammer piling machines, although at first the pile may be driven with facility, a point may be rapidly attained when the resistance and yielding of the pile will render the blow useless. For suppose, at a given point, the fall required to compensate the defective hardness be 1 foot, then, when the resistance is doubled, the fall must be 4 feet, whereas the stroke of Nasmyth's ram is only 3 feet. On the other hand, when the ram is raised to the same point throughout the driving of a pile, the deeper the pile is in the ground, and

consequently the greater the resistance, the greater too is the power of the ram.

It appears also from the equation (3), that the heavier the ram, the less is the height of fall lost; and since it was found before, that in regard to the effect, when the inertia of the pile is taken into consideration, the heavier the ram is, the better the effect; therefore, on both accounts, it is desirable to have as heavy a ram as possible.

Description of improved steam pile driving machine.—The new steam pile driver, forming the further subject of the present paper, was designed for the purpose of constructing a wharf or quay on the river Blyth, above the entrance to the proposed new docks near the mouth of the river; and it was constructed in accordance with the principles laid down in the former part of the paper.

The machine is designed to drive two face piles and one land tie pile whilst in one position. It consists of two ordinary leading frames, braced together, at the proper distance apart for the two piles to be driven, and hinged to a frame supported on the main framework, for the purpose of adjusting them exactly to the required angle of the piles; in which position they are supported at back by ties or struts. The timber frame to which the hinges and ties are attached, is independent of the lower platform, upon which it rests, and is capable of being moved backwards or forwards upon it, so as to bring the leaders into the exact position for the piles; but when in work, this timber frame is held down to the lower platform by bolts. The movement of the frame upon the platform is accomplished by means of wheels on each side: under the wheels are placed tapered iron wedges, so that a small turn of the wheels is sufficient to raise the frame slightly from its platform; thereby removing the friction, which would prevent motion, and at the same time effecting the small movement necessary for adjustment; the wedges are then driven out from under the wheels, by the blow of a hammer.

The main framework is composed of timbers strongly braced together by diagonal ties, and it runs upon a railway laid on the ground; it is made sufficiently high to keep the platform always above high-water. The machine is moved along the rails by means of chains attached ahead and astern to screw moorings sunk in the ground: the chains pass round pulleys fixed to the main frame, up to the crabs, and wind upon end drums; they are stopped or locked on the platform, and unwound from the drums when the machine has been moved the required distance. At the back of the machine is a leading frame for driving the land tie pile. On the platform is placed a portable steam-engine, with two crabs, each working a ram in the usual way. The crabs are furnished with clutches for throwing them in and out of gear, and with brakes. The clutches are connected together, so that when one drum is in gear, the other is out of gear; the means of disconnecting is by a weighted lever, which is loose upon the spindle, and acts by catching in notches.

The method of working is as follows:—one drum having been put into gear by the weight on the hand gear lever, the ram is being wound up: during this time the lever, with its weight, is turned over to the other side; the tendency of the weight is then to throw the clutch of the working drum out of gear, but the friction produced by the strain

of winding the ram prevents disengagement; when, however, the strain is relieved by the release of the ram, the weight throws the working drum out of gear, thereby preventing the further ascent of the monkey or claw, which lays hold of the ram, and throws the other drum into gear, which in its turn lifts the other ram. The monkey of the first ram now descends to lay hold of the ram again, a brake being put on to check its velocity; and the handle is reversed, to be in readiness again to disconnect the clutch of the working drum when the second ram has reached the top. In this way the operation is continuous, the engine is neither stopped nor reversed, and no time is lost.

The weight of the ram is 1½ ton, and including the weight of the monkey and friction, the strain on the chain and machinery is considerably greater. From the high velocity at which the crabs are driven, this strain would be felt as a sudden tug on beginning to raise the ram, which neither chain nor framework could be expected to bear without injury; and hence arose the necessity of providing something in the form of a buffer to mitigate the intensity of the strain. It consists of a cylinder, furnished with a piston, on the upper side of which is a strong volute spring, requiring 1½ ton to compress it. The travel of the piston is 4½ inches, and the chain is wound up for this length before the ram rises, the strain gradually increasing up to 1½ ton. During the ascent of the ram the spring remains composed; but on arriving at the top of the machine, the ram is suddenly disengaged, and the whole weight being removed, the rebound of so powerful a spring would probably drive the piston through the bottom of the cylinder; this is prevented by admitting air into the cylinder through a small orifice at the bottom, and thus providing a cushion for the piston, the orifice being so minute that it takes the whole time of the ascent of the ram to fill the cylinder, and the air cannot escape in a moment. The formation of a vacuum below the piston, and the compression of the air above, assist the spring in its action.

The piles are floated to the place in rafts; and the rams being made fast at the top of the machine by a pin, passed though the leaders, the working chains are detached, and hooked to a pair of dogs, fastened on a pile, which is then raised, and pitched to its place by the engine. The operation is performed with astonishing quickness, but this depends, in a great measure, upon the facility obtained by a peculiar kind of slip-hook for attaching the chain to the monkey. With facility for immediate detachment, the hook combines the advantages of great security, strength, and provision against accidental detachment by the upward blow.

In driving sheet piles below the level of the gauge piles by other steam pile driving machines, such as Nasmyth's, it is necessary to use a dolly or intermediate piece of timber, by which a great part of the effect is necessarily lost; but in the new machine the use of a dolly is unnecessary; for by reversing the piston of the monkey-lever, and making it project outwards instead of inwards, so as to clear the frame, the ram will descend to the ground.

The new pile driver, above described, was designed to obviate the difficulties that would have attended the adoption of any of the methods previously in use. To drive the piles, by the ordinary hand-engine, would have been a work of considerable time; for not only is a hand-

engine very slow in its operation, but it would have been only at low-water of the spring-tides that the work could be done. Nor would any of the methods hitherto employed for applying steam-power, meet the exigencies of the present case. For, in the first place, the ordinary travelling steam-engine could not be applied to work the crabs of hand-engines, on account of the rise of the tide; nor could it be placed beyond the influence of the tide, because the beach being flat, the space between the new wharf and the shore, which is covered at high-water, is considerable; nor could it have been used with a piling engine on a barge, for, not to mention the swell in the river, the ground is in some parts sometimes, and in other parts always, bare at low-water. Nor were the elaborate machines that have been constructed by Nasmyth and Morrison, acting on the principle of the steam-hammer, more applicable in the present case. It would have been necessary either to make a strong frame to carry their great weight, in which case rails laid upon the sand would not have been sufficient; or else to drive a large number of extra piles by hand to form a gantrey. Moreover, these machines are expensive; and being applicable only to the purpose of driving piles, must be idle when that work is done.

From these considerations, it was resolved to attempt the present arrangement, which has proved entirely successful. The new machine costs only a fourth of those referred to above, and is only about a fourth of the weight: it will do as much work per day in many cases, and will do it better and more cheaply. The whole work of pitching and driving the piles and moving the machine is effected in the new pile driver by a 4-horse power engine; whilst in the others there are two complete separate engines of greater power: and although the latter machines will do more work per minute while they are in motion, in consequence of their greater power, in many cases they will not perform more per day, on account, principally, of the difficulty of moving them: moreover, the great weight of these machines requires that a good foundation and a strong superstructure be provided to carry them, before they can be moved forwards. This was proved in a recent case where Nasmyth's machine was employed, by the fact that, although it could drive one pile in 20 minutes, yet the average per day was only 10 piles driven,—an amount of work which the new machine will do easily. With respect to the quality of the work executed, the comparison is again in favor of the new machine; the piles are driven with rare precision,—the profile of the work being almost perfect; the heads of the piles are not bruised, and when the rings are removed there is hardly any appearance of abrasion. With regard to cost of working, the steam is kept up all day in the other machines, although the engine is only at work about three hours, and there is a great loss from condensation and leakage in the steam-pipes; and as the power and dimensions of both engines and boilers are also much greater than in the new machine, there must necessarily be a larger expenditure of fuel. Although, however, the other machines were inapplicable in the case for which the new machine was designed, there are circumstances in which they would be more effective than the new engine; such as when a great number of piles were to be driven in a limited area.

One of the disadvantages of contracts for harbour works is the large amount of money sunk in plant; every different kind of the work re-

quiring different machinery and tools. The new piling machine, however, is not a piling machine only, as in the case of the other machines, but may be used also as a steam-crab; or, if taken to pieces, there is a portable engine complete in itself, and applicable to other purposes, a pair of crabs, and the leaders and rams, which would go to form two hand piling engines, the only special expense being the lower framework and the fitting together of the various parts.

PROVISIONAL PROTECTIONS GRANTED.

Cases in which a Full Specification has been deposited.

2849. Edward Halliday Ashcroft, of Massachusetts, U.S.A., for an improved mode of preventing the overheating and bursting of steam-boilers, —being a communication.—[*Dated November* 11*th.*]

2879. John Gedge, of Wellington-street, for improved means for stopping or retarding carriages used on ordinary roads,—being a communication.—[*Dated November* 17*th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1824. John Talbot Pitman, of Gracechurch-street, for an improved method of making carburetted hydrogen gas,—being a communication.—[*Dated June* 30*th.*]

2288. John George Taylor, of Glasgow, for improvements in the construction and alteration of doors, shutters, blinds, and other closures to buildings and erections, so as to allow of their illumination; which improvements are also applicable to omnibuses and other vehicles, and to clock dials, lamps, and postal pillars.—[*Dated September* 1*st.*]

2300. Thomas Hardcastle, of Bradshaw, near Bolton-le-Moors, for improvements in machinery for washing textile fabrics, and fibrous substances. —[*Dated September 2nd.*]

2392. Thomas Archer, jun., of Dunston, Gateshead, for improvements in machinery for cutting off and heading lengths of metal, applicable to the manufacture of rivets and other articles.—[*Dated September* 15*th.*]

2448. Elizabeth Burton West, of Kent-terrace, Regent's-park, for improvements in the manner of preparing and applying materials used in brewing to that purpose, and in the various processes and apparatus used in connection with the same, and for novel apparatus connected with the same, —being a communication.—[*Dated September* 21*st.*]

2498. William Wall White, and William Bull, both of Saint John's-square, Clerkenwell, for improvements in rollers applicable for blinds, maps, and other purposes.

2502. Richard Williams, of Bishop's-road, Victoria-park, for the manufacturing of soap with materials hitherto not introduced by any person in the chemical combination of various ingredients, when manufactured, known by the name of soap.

The above bear date September 29th.

2524. Sydney Doolan Hamilton, of Great James-street, Bedford-row, for improvements in Jacquard machinery,—being a communication.—[*Dated October* 1*st.*]

2536. John Dyson, Edwin Wilkinson Shirt, and Henry Shirt, all of Tinsley Works, near Sheffield, for improved straps or driving bands for machinery. [*Dated October 3rd.*]

2552. James Combe, of Belfast, for improvements in machinery for hackling and preparing flax and other fibrous substances.—[*Dated October 5th.*]

2555. Edward Cavendy, of New York, U.S.A., for an instrument in taking zenith observations at sea (when the horizon is obscured) of any planet. —[*Dated October 6th.*]

2591. Léon Pujol, of Paris, for improvements in envelopes and letter paper. [*Dated October 9th.*]

2597. Claude Nicolas Leroy, of Paris, for preventing accidents and collisions on railways.—

2598. George Frédéric Lombard, of Paris, for improvements in steam-engines.

The above bear date October 10*th.*

2610. Prodromos B. Kyishogloo, of Constantinople, for improvements in obtaining and applying motive power. [*Dated October* 12*th.*]

2612. William Brookes, of Chancery-lane, for improvements in combing wool and other fibres,—being a communication.

2614. Charles Coffey Alger, of Newburgh, State of New York, U.S.A., for an improved furnace for smelting iron.

2615. Edward Deane, of Arthur-street, London-bridge, for an improved weapon to be used either as a sword or as a pistol, or both.

2616. Thomas Bell, of Plaistow, Essex, for improvements in the manufacture of alkaline salts.

2618. Meliton Martin, of Madrid, for improved apparatus for retarding and stopping railway carriages.

2620. James Yates, of Little Bolton, Lancashire, for improvements in machinery or apparatus used in prèparing and spinning fibrous materials.

The above bear date October 13*th.*

2622. C. G. Kopisch, of Gibson-square, Islington, for improvements in propelling vessels by means of heated air, without screw or paddle, thereby saving fuel and ship's room.

2624. Adolphe Barthélemy Ellena, of Paris, for a new mechanical means of rocking cradles.

2626. John Henry Johnson, of Lincoln's-inn-fields, for improvements in producing figured paper, to be used in teaching writing and drawing,—being a communication.

2628. Frederick Hale Holmes, of Blackwall, for improvements in magneto-electric machines.

2630. Thomas Restell, of New Kent road, for improvements in br[illegible] loading firearms, in proje[illegible] in cartridges for breech-l[illegible]

2631. Joseph Parker, of S[illegible] for an improved me[illegible] and working Venetia[illegible] lar blinds used as ventilators or screens, or both.

2632. John Croft Plomley, of Maidstone, for an improved method of drying malt, hops, and other produce.

2633. Godfrey Rhodes, of Ship-street Barracks, Dublin, for a parabolical or bell-shaped, or other shaped, camp or field tent, without any centre support or pole.

The above bear date October 14*th.*

2634. Edward Wilkins, of Walworth, for improvements in frames for horticultural and vegetative purposes.

2635. William Ashby Rooke, of New Brentford, for using and employing dextrine in the making and sizing of paper.

2636. Charles Reeves, of Birmingham, for an improvement or improvements in the manufacture of swords, matchets, and knives.

2637. Robert Glass Balderstone, of Bishopbriggs, Lanark, N.B., for apparatus for cultivating land.

2638. Frederick Priestly, of Berners-street, Oxford-street, for improvements in signal instruments or apparatus for making or transmitting electric telegraphic signals.

2639. Thomas Richardson, of Newcastle-upon-Tyne, and Manning Prentice, of Stowmarket, for improvements in the manufacture of salts and preparations of phosphoric acid.

2640. William Brown Hopper, of Camberwell, for improvements in floating docks.

2642. Joseph Gibbs, of Abingdon-street, for a method of treating *Phormium tenax*, in order to render it fit for the manufacture of pulp.

2643. Paul Heilmann, of Mulhouse, France, for certain improvements in spinning silk, cotton, wool, and other fibrous substances.

2644. Charles Walker, of New Lanark, N.B., for improvements in atmospheric railways.

2645. Charles Walker, of New Lanark, [illegible] r improvements in the manu- [illegible] of manure from sewerage or [illegible] matters.

[illegible] ge Scarr, and James Pollard, [illegible] f Burnley, Lancashire, for [illegible] improvements in power looms [illegible] aving.

2647. Richard Wright, of Brighton, for improvements in the application of certain fluid and other matters to heating purposes, and in apparatus for the same.

The above bear date October 15th.

2648. David Guthrie, and Josiah Vavasseur, of New Park-street, Southwark, for a machine for cutting, chipping, or rasping dye-woods or other similar fibrous substances, for the purpose of obtaining extracts.

2649. John Wright, of Sheffield, for improvements in preparing or treating strips of steel for hardening and tempering.

2650. Ward Holroyd, of Halifax, and Samuel Smith, of Shipley, near Bradford, Yorkshire, for improvements in looms for weaving.

2651. Julian Bernard, of the Albany, for certain improvements in the manufacture or production of boots and shoes, or other coverings for the feet, and in machinery, apparatus, and materials to be employed in such manufacture.

2652. Lucien Arbel, of Rive de Gier, France, for certain improvements in manufacturing wheels for carriages on railways

2653. Richard Archibald Brooman, of Fleet-street, for an apparatus for scoring games and points at games, —being a communication.

2654. James Chadwick, of Castleton Print Works, near Rochdale, for improvements in rollers or cylinders for printing or staining the surfaces of woven fabrics, yarns, paper, and other materials.

The above bear date October 16th.

2655. Thomas Holt, of Little Bolton, Lancashire, for improvements in looms.

2656. Richard John Badge, of Newton Heath, near Manchester, for an improved mode or method of securing railway chairs to the sleepers.

2657. Joseph Bentley, of Liverpool, for improvements in firearms.

2658. Edward Humphrys, of Deptford, for improvements in engines worked by steam or vapour.

2659. James Eastwood, of Derby, for an improvement in working the valves of steam hammers by a direct self-acting motion.

2660. Richard Archibald Brooman, of Fleet-street, for improvements in forming the joints of pipes, for conveying water, gas, and other fluids, —being a communication.

2661. Thomas Massey, of Birchin-lane, and Thomas Savage, of Soley-terrace, Pentonville, for improvements in sounding machines.

2662. William Osborne, of Bow Churchyard, for improvements in ladies' petticoats, under skirts, and dresses.

2663. Leon Lewenberg, of New York, for improvements in railway alarms and marine alarms or fog signals.

The above bear date October 17th.

2664. Luigi De Cristoforis, of Lower Thames-street, for an improvement on the system of vehicle wheels, to be called the "De Cristoforis Conical Wheels."

2665. John James Sieber, of Baring-street, New North-road, for improvements in power looms,—being a communication.

2667. Victor Péan, of Paris, for improvements in protecting the walls, ceilings, wainscots, and other parts of buildings from humidity.

2669. Richard Archibald Brooman, of Fleet-street, for improvements in producing figured fabrics in which the design is applied by printing,—being a communication.

2670. Benedict Barnard, and Alfred Rosenthall, both of Cheapside, for a new ornamental fringe or fringed fabric; also the means of producing the same.

2671. Michael Henry, of Fleet-street, for improved machinery for unmaking rope or cordage,—being a communication.

2672. Henry Wimball, of Aldermaston, Berks, for improvements in machinery or apparatus for the manufacture of bricks, tiles, pipes, and other articles of a similar nature.

2673. Edward Cockey, Henry Cockey, and Francis Christopher Cockey, of the Frome Iron Foundry, Somersetshire, for improvements in regulating the flow of fluids.

2674. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the manufacture of drawing rollers,—being a communication.

2675. William Bentham, of Halifax, Yorkshire, for improvements in harmoniums and other similar reed instruments.

2677. David Patridge, of Tavistock-place, Plumstead-common, for improvement in shaft bearings.

The above bear date October 19th.

2678. Marc Antoine François Mennons, of Rue de l'Abbaye-Montmartre, Seine, France, for an improved hydraulic press,—being a communication.

2679. Edward Briggs, of Castleton Mills, near Rochdale, for an improved manufacture of printed piled fabric.

2680. Robert Atkinson, and Thomas Brearey, both of Baildon, near Bradford, Yorkshire, for improvements in loom pickers.

2681. George Horatio Smith, of Norfolk-street, Strand, for an improved governor or regulator for steam and other engines.

2682. Frances Windhausen, of 1 uderstadt, Hanover, for improvements in increasing the adhesion of the wheels of locomotive engines to rails when moist.

2683. John Henry Johnson, of Lincoln's-inn-fields, for improvements in Jacquard machines, and in the cards employed therein,—being a communication.

The above bear date October 20th.

2685. Isaac Storey, and John Henry Storey, both of Manchester, for improvements in water gauges for steam boilers, and in taps for steam and other fluids.

2686. Robert Clark, of Glasgow, for improvements in effecting the consumption or prevention of smoke; applicable to steam-boilers and other furnaces.

2688. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in the construction of sewing machines, and in the mode of operating such machinery,—being a communication.

2689. Robert Duke, of Dover, for improvements in the means of communicating power to ships' pumps.

The above bear date October 21st.

2690. Charles Reeves, of Birmingham, for improvements in repeating or revolving firearms.

2691. John Bethell, of Parliament-street, Westminster, for improvements in machinery or apparatus for trenching, cutting, digging, and cultivating land.

2692. James Hinks, of Birmingham, for an improvement or improvements in stiffeners for wearing apparel.

2693. Alexandre Henri Charles Chiandi, of Paris, for improvements in the manufacture and combustion of certain products of peat, and in the apparatus employed therein.

2694. Marc Antoine François Mennons, of Rue de l'Abbaye-Montmartre, France, for certain improvements in machinery for the preparation of peat, —being a communication.

2695. Thomas Hamilton, and James Hamilton, both of Glasgow, for improvements in turning, cutting, shaping, or reducing wood and other substances.

2696. John Milne, of Royton, Lancashire, for certain improvements in carding engines.

2697. Thomas Cardwell, of Manchester, for improvements in machinery for compressing cotton and other articles.

2698. David Hogg Saunders, of Rattray, Perthshire, N.B., for improvements in the preparation and manufacture of textile fabrics and materials.

2699. James Smith, of Bristol, for improvements in horsehair crinoline for petticoats.

The above bear date October 22nd.

2700. Thomas Rand, and George Beckley, both of Oxford-street, for an improvement in saddletrees.

2701. Benjamin Parker, of Clapham, for improvements in the permanent way of railways.

2702. Alexander Theophilus Blakely, of Tunbridge Wells, for improvements in laying submarine telegraphic cables.

2703. Robert Harrild, and Horton Harrild, both of Farringdon-street, for an improvement in the manufacture of the composition used for printers' rollers.

The above bear date October 23rd.

2705. Felton Charles Kirkman, of Royal-street, Lambeth, for improvements in machinery for winding and unwinding ropes and cables, which is

applicable to electric cables for submarine purposes.

2706. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for an improvement in the process of making wrought-iron beams or girders,—being a communication.

2707. John Macintosh, of North-bank, Regent's-park, for improvements in the construction and laying of telegraphic cables.

2708. James Thom, and Hugh Mc-Naught, both of Glasgow, for improvements in looms for weaving.

2709. John Michael Pearson, of Basing-hall-street, for improvements in the manufacture of coke,—being a communication.

The above bear date October 24th.

2711. James Fairclough, John Fairclough, and Joseph Cowan, all of Liverpool, for improvements for suspending and working window hangings and other drapery curtains.

2713. Charles de Clippéle, of Brussels, for improvements in the manufacture of boots and shoes, harness and driving straps, which improvements are applicable to uniting various materials together, and also for waterproofing.

2715. The Reverend John Walter Lee, of Chelmsford, for improvements in communicating between the different parts of railway trains.

2717. Aaron Marks, of London-wall, for an improved fastening for gloves and other articles.

The above bear date October 26th.

2719. Charles Cadby, of Liquorpond-street, for improvements in piano-fortes.

2721. James Newall, of Bury, Lancashire, for improvements in railway breaks and signals, and in the machinery or apparatus for working the same.

2723. Marc Antoine François Mennons, of Paris, for an improved varnish,—being a communication.

The above bear date October 27th.

2725. William Irlam, of Newton Heath, near Manchester, for improvements in wrought-iron railway chairs, sleepers, and crossings.

2727. John Addison, of Tours, France, for discovering and destroying hydrogen, or carburetted hydrogen gas, and other gases in coal-mines, dwelling-houses, or other places.

2729. William Smith, of Salisbury-street, Adelphi, for improvements in couplings or connections for shafts, —being a communication.

2731. Abel West, of Wormley Ring, Hoddesdon, Hertfordshire, for improvements in the manufacture of candles.

2733. George Shillibeer, of Commercial-place, City-road, and George Giles, of Gray's-inn-square, for improvements in omnibuses.

2735. William Clark, of Chancery-lane, for an improvement in rails for railways,—being a communication.

2737. William Clark, of Chancery-lane, for certain improvements in machinery for carding cotton, wool, and other fibrous substances,—being a communication.

2739. Elizabeth Mc Dowall, of Johnstone, Renfrew, N.B., for improvements in steam hammers,—being a communication by her late husband.

2741. Henry Taylor, of Staley Bridge, Lancashire, for an improvement in the "cans" employed in connection with machinery for preparing cotton and other fibrous materials for spinning.

2743. Robert Alexander Ronald, of Paisley, for improvements in the manufacture of shawls.

The above bear date October 28th.

2745. William Delf, junior, of Great Bentley, Essex, for improvements in ploughs.

2746. Pietro Feloj, of Holborn Hill, for the improvement of an illuminating reflector of light from gas, oil, or candle.

2749. David Allison, and John Livingston, both of Manchester, for improvements in machinery or apparatus for regulating the weight or pressure to top rollers used in spinning or preparing fibrous materials to be spun.

2751. Jonas Craven, of Bradford, Yorkshire, for improvements in machinery or apparatus used in weaving.

2753. George William Robinson, of Barton-on-Humber, for improvements in clod-crushing rollers.

The above bear date October 29th.

2755. Joseph Boyes Fraser, of Kenilworth, for an improvement or improvements in lubricating shafts, axles, screws, and other articles requiring lubrication.

2757. William Clark, of Chancery-lane, for improvements in tackle blocks,—being a communication.

2759. William Harwood, of Mendlesham, Suffolk, for improvements in reaping machines.

2761. John Lawson, of Leeds, for improvements in machinery for roving flax and other fibrous substances,—being partly a communication.

2763. Samuel Knowles, of Tottington Mill, near Bury, Lancashire, for improvements in "dunging" fabrics preparatory to dyeing.

The above bear date October 30th.

2765. George Bell Galloway, of Basinghall-street, for improvements in the construction of merchant ships and other vessels in motive powers, propulsion, and boiler furnaces.

2767. James Owen, of Worsley, Lancashire, for certain improvements in machinery or apparatus for the prevention of accidents; applicable to hoisting and other lifting machines.

2769. Richard Martin, Ebenezer Hall, and Joshua Hall, all of Shrewsbury Works, Sheffield, for improvements in steam hammers.

2771. Richard Archibald Brooman, of Fleet-street, for improvements in the construction of boats,—being a communication.

2772. Johan Julius Schuessel, of Breslau, Prussia, and Peter Julius Thouret, of Berlin, for the manufacture of a composition which will render inflammable materials incombustible.

2773. William Woodhead, James Woodhead, and John Woodhead, of Eccleshill, near Leeds, for improvements in the manufacture of kiln tiles, and in the machinery or apparatus employed therein.

2775. Prodromos B. Kyishogloo, of Constantinople, for improvements in obtaining and applying motive power.

2777. George Hallen Cottam, and Henry Richard Cottam, both of the St. Pancras Iron Works, for improvements in stable fittings.

The above bear date October 31st.

2779. Robert Kirkman, of St. Helen's, Lancashire, for improvements in the fusees of lever and other watches.

2781. Eugene Murray, of Woolwich, for preventing accidents on railways.

2783. Charles Iles, of Birmingham, for improvements in wardrobes or similar receptacles for articles of dress, and in stands, frames, and pins for holding or suspending articles of dress.

2785. James Apperly, and William Clissold, both of Dudbridge, Gloucestershire, for improvements applicable to carding and condensing engines.

The above bear date November 2nd.

2789. James Edward Boyd, of Lewisham, for improvements in skates.

2791. David Harcourt, of Lozells, Birmingham, for improvements in wrenches.

2793. Rudolph Wappenstein, of Manchester, for improvements in doctors or scrapers used for cleaning engraved surfaces.

2795. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved machinery for cutting files,—being a communication.

The above bear date November 3rd.

2797. Richard Laming, of Hayward's Heath, Sussex, for improvements in purifying gas, and in apparatus useful for that purpose.

2799. Francis Higginson, of Woodlands-cottage, Eling, Hampshire, for submerging, extending, and laying down submarine, electric, magnetic, and every other description of submerged or immersed electrical telegraph cables, wire ropes, and combined wire, gutta-percha, spun yarn, or other compound electrical cables whatsoever.

2801. Romain Ignace Charles Dubus, of Brussels, for a method of treating certain plants or vegetable substances, in order to extract from the same, first, a kind of fecula or farina, proper both for alimentary and finishing or starching purposes; second, an alcoholic liquor; and, third, a natural ferment or yeast.

2803. Charles Clay, of Walton, near Wakefield, Yorkshire, for improvements in machinery for grubbing or cutting up weeds, and otherwise scarifying and cultivating land.

2805. Joseph Miller, of Alpha-road, Regent's-park, for an improved arrangement of marine steam-engines.

The above bear date November 4th.

2807. Joseph Bunnett, of Deptford, for improvements in machinery for bending and shaping metals.

2809. George Robinson, of High-street, Deptford, for improvements in apparatus for shelling or hulling coffee and other berries and seeds.

2811. John James Cousins, of Park-lane, Leeds, for improvements in the construction of steam ploughs.

2813. William Sharman, of Sheffield, for an improved metallic compound, applicable to the manufacture of useful and ornamental articles for which German silver and compounds resembling German silver are at present used.

The above bear date November 5th.

2815. Frederick Lipscombe, of the Strand, for improvements in the mode of conveying water and other liquids.

2817. Germain Canouil, of Paris, for improvements in the manufacture of matches.

2819. Henry Bessemer, of Queen-street-place, New Cannon-street, for improvements in the manufacture of malleable iron and steel, and also in the manufacture of railway bars, and other bars, plates, and rods, from iron or steel so manufactured.

The above bear date November 6th.

2821. Hugh Baines, of Manchester, for improvements in machinery or apparatus for the prevention of accidents; applicable to hoisting and other lifting machines.

2823. John Henry Pepper, of the Royal Polytechnic Institution, for improvements in displaying various devices when revolving discs or surfaces are used.

2825. William Wilson, of Canterbury-place, Newington, and James John Joseph Field, of Sussex-street, Wandsworth-road, for improvements in casting or moulding liquefied and other substances.

The above bear date November 7th.

2827. Walter Hardie, of Pitt-street, Edinburgh, for an improved stereoscope.

2829. Pier Alberto Balestrini, of Brescia, Italy, for improvements in machinery and apparatus for paying out submarine telegraph cables, and for regulating and controlling the paying out thereof.

2833. George Weedon, of Gloucester-place, Portman-square, and Thomas Turner Weedon, of Plumstead, Kent, for an improved knife-cleaning machine.

The above bear date November 9th.

New Patents.

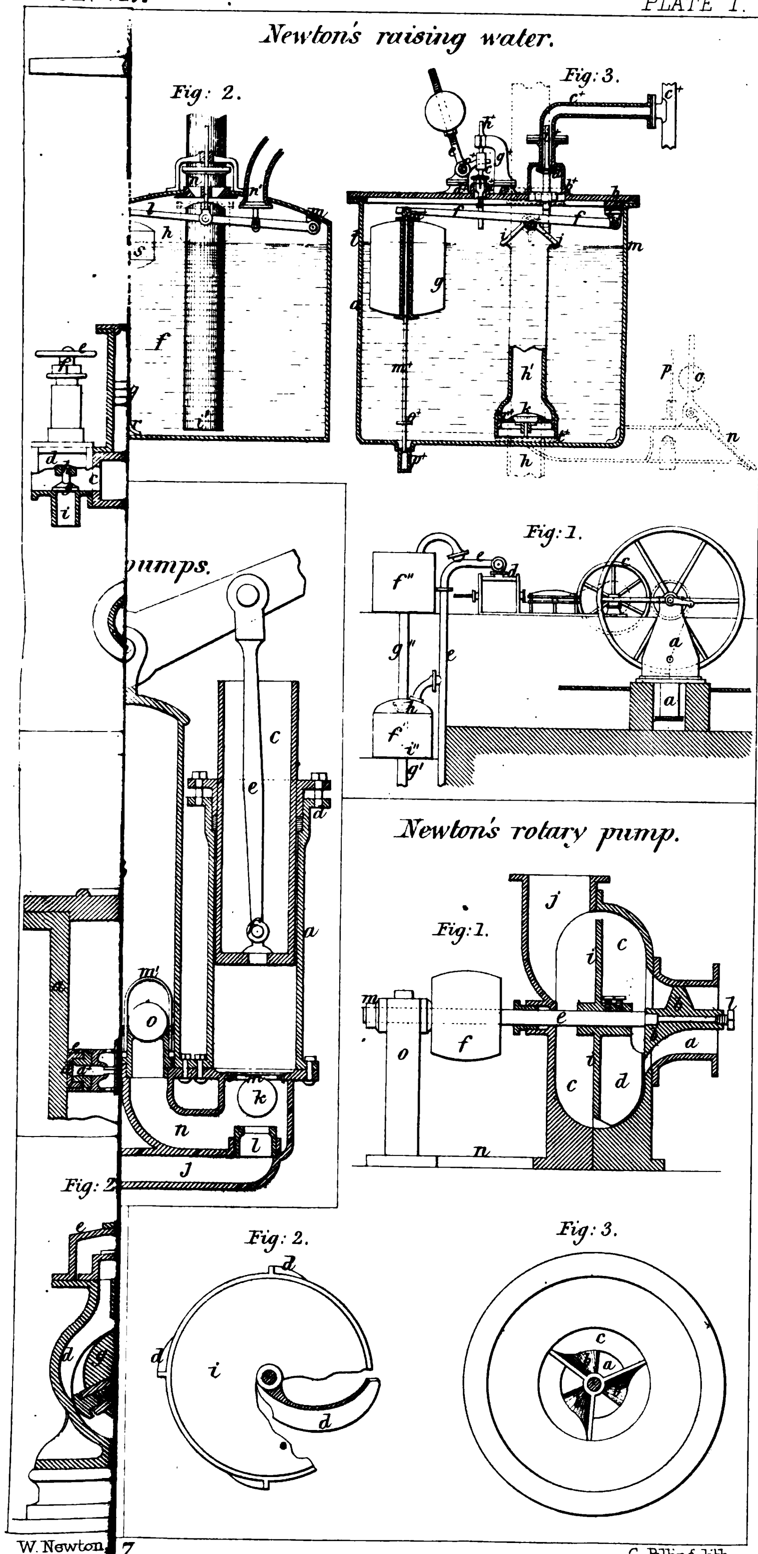
Sealed under Patent Law Amendment Act, 1853.

1857.

348. N. Nomico and G. Heyes.
1181. Polydore de Keyser.
1183. E. F. Barnes.
1185. John Macintosh.
1190. Heinrich Hochstaetter.
1198. J. Ramsbottom and J. Bailey.
1213. Henry Ball.
1218. Samuel Mortimer.
1221. George Powers.
1225. John Collins.
1229. Edward Hawkes.
1232. A. A. Blandy.
1233. R. Leake and M. Sykes.
1238. Henry Levy.
1240. A. J. Paterson.
1241. J. Davy and W. Bentley.
1246. W. E. Wiley.
1250. John Fox.
1255. W. E. Wiley.
1256. John Leslie.
1258. J. T. Way.
1259. George Travis.
1265. J. T. Pitman.
1269. W. B. Paul.
1270. William Wilkins.
1274. J. P. Becker.
1275. G. K. Geyelin.
1277. William Hood.
1280. Henry Hogarth.
1281. Matthew Semple.
1287. Ernst Ziegler.

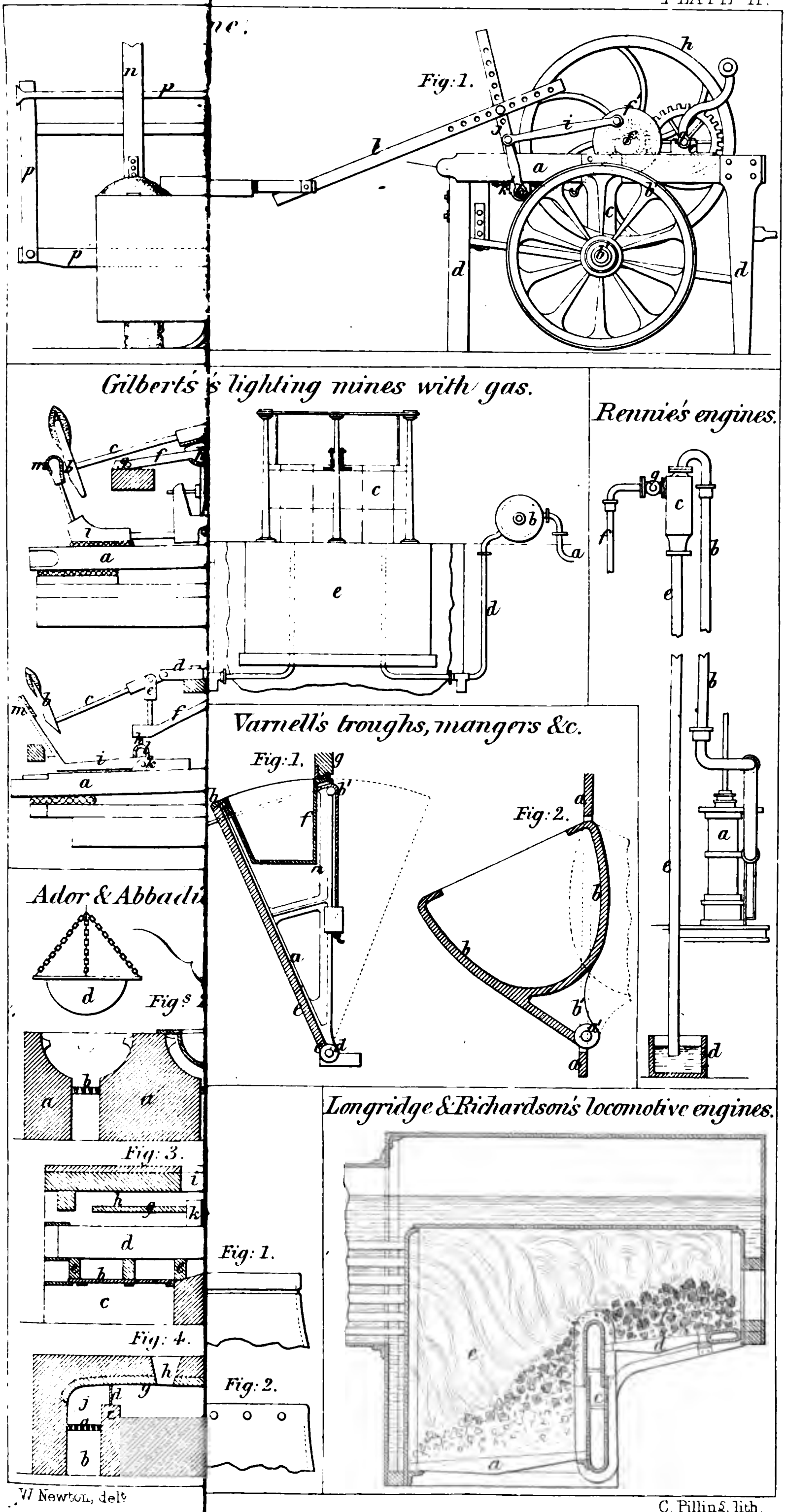
1288. Herbert Mackworth.
1289. C. W. Ramié.
1291. Duncan Morrison.
1294. C. T. Bright and C. De Bergue.
1296. L. C. Dolléans.
1308. George Heppell.
1315. John Pym.
1318. J. J. Myers.
1324. J. D. Mucklow.
1326. Samuel Hallett.
1328. C. Hall and T. Charlton.
1335. J. D. Malcolm.
1339. R. A. Brooman.
1341. W. E. Newtou.
1342. W. Massey and J. Smith.
1343. William Massey.
1344. T. Briggs and J. Starkey.
1347. Edward Eley.
1348. H. Tolkien and J. Middleton.
1351. R. D. Kay.
1359. William Sissons and P. White.
1360. William Ashby.
1362. David Hesse.
1366. James Sharrocks.
1367. Daniel Reading.
1368. John Carr.
1369. C. Bartholomew and J. Heptinstall.
1370. Joseph Aizlewood.
1372. W. H. King.
1373. Frederick Whitaker.
1374. R. P. Walker.
1378. Edward Gripper.
1379. Sophia Sands.
1381. R. A. Brooman.
1382. R. A. Brooman.
1383. Francis Parker.
1386. Henry Jones.
1387. Henry Trappes.
1388. G. H. Creswell.
1389. Joseph Ellis.
1390. Charles Cowper.
1394. Rudolph Bodmer.
1398. J. Apperly and W. Clissold.
1400. C. F. Vasserot.
1402. T. W. Roys.
1403. Charles Reeves.
1405. J. F. P. L. Von Sparre.
1410. M. B. Rowland.
1412. C. W. Harrison.
1414. Abel Foulkes.
1419. G. Sharp, and A. W. Elder.
1421. E. Aldis.
1422. John Harrisson.
1423. J. Abbot, R. H. Thomas, J. Young, and J. E. Hunt.
1424. Joseph Jakens.
1427. William Clark.
1432. William Owen.
1434. William Todd.
1450. Samuel Fox.
1453. William Carron.
1458. T. H. Roberts.
1459. Thomas Silver.
1460. G. O. De la Barre.
1461. John Phillips.
1476. John Earnshaw, jun.
1477. L. D. Aubert.
1478. W. S. Underhill.
1482. William Hart.
1490. William Holland.
1493. R. Low and W. Press.
1495. Edward Welch.
1498. V. Bacqueville Pieters.
1506. Thomas Grahame.
1507. T. T. Jopling.
1508. E. P. Griffiths.
1513. Thomas Hart.
1514. Nathaniel Cox.
1517. T. Willis and G. Chell.
1520. James Merrylees.
1530. J. James and W. D. Grimshaw.
1541. J. A. Salmon.
1543. George Tingle.
1587. W. E. Newton.
1606. William Wright.
1607. John Robertson.
1633. A. V. Newton.
1634. A. V. Newton.
1639. James Robertson.
1673. A. V. Newton.
1677. T. W. Lord.
1697. Henry Brinsmead.
1703. Thomas Ward.
1795. John Bourne.
1798. W. Crook, G. Rushton, and J. Crowther.
1820. Henry Gilbee.
1831. Joseph Nickless.
1872. William Munt.
1880. Frederick Bousfield.
1902. N. M. Cummins.
1948. W. E. Newton.
1961. T. M. Smith.
1986. Alfred Upward.
1989. A. D. Lacy and W. C. Homersham.
2011. Andrew Scott.
2018. Henry Doulton.
2053. William Hirst.
2136. G. Collier, W. Noble, and W. Holroyd.
2183. Richard Hoe.
2230. F. A. Gatty.
2249. James Ronald.
2298. Rudolph Sack.
2329. P. A. Le Comte de Fontainemoreau.
2349. L. L. H. Bertou.
2391. G. J. Bensen.
2424. Richard Watson.
2508. Rudolph Bodmer.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*



W. Newton. 7.

C. Pilling, lith.



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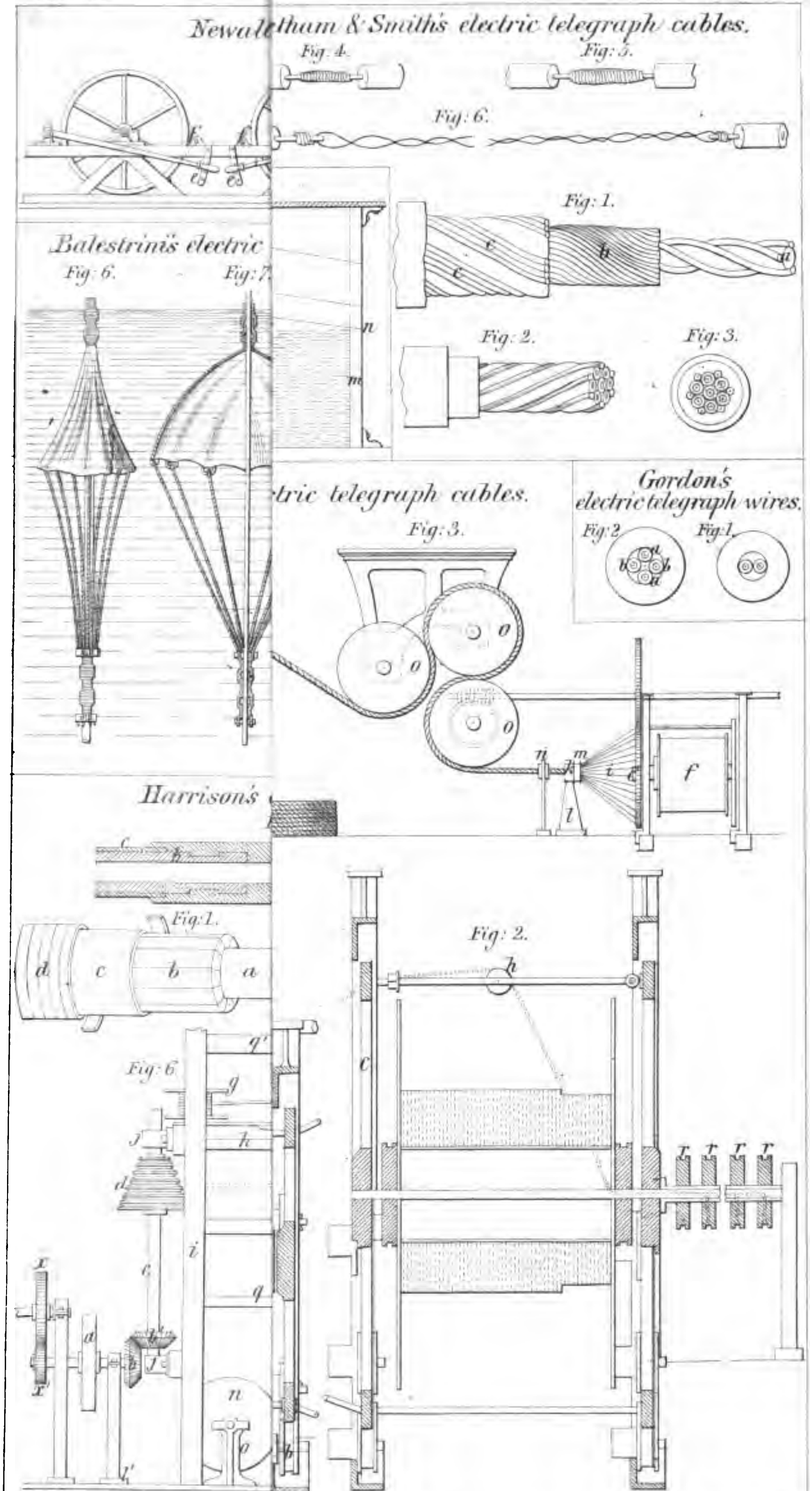
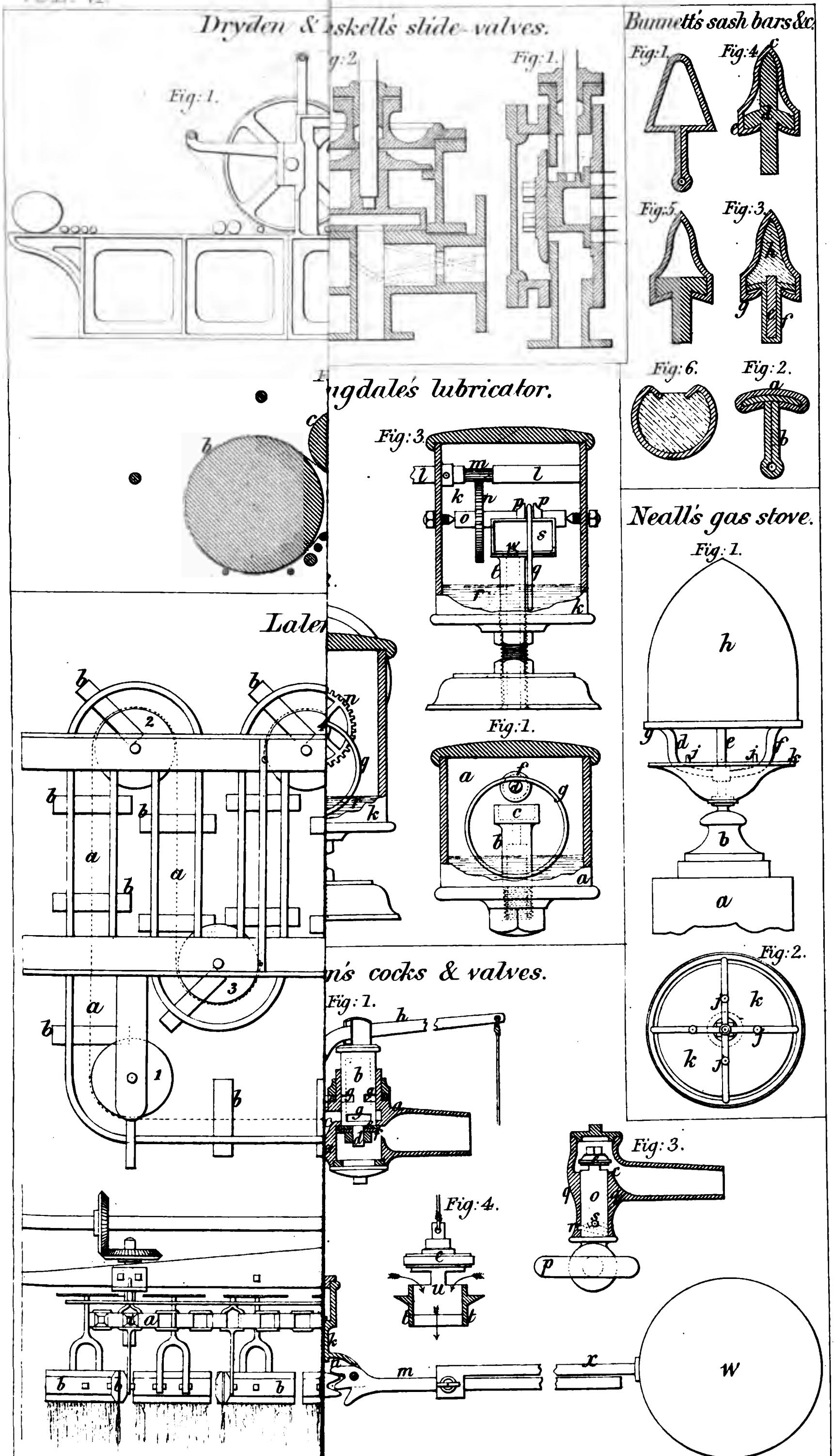
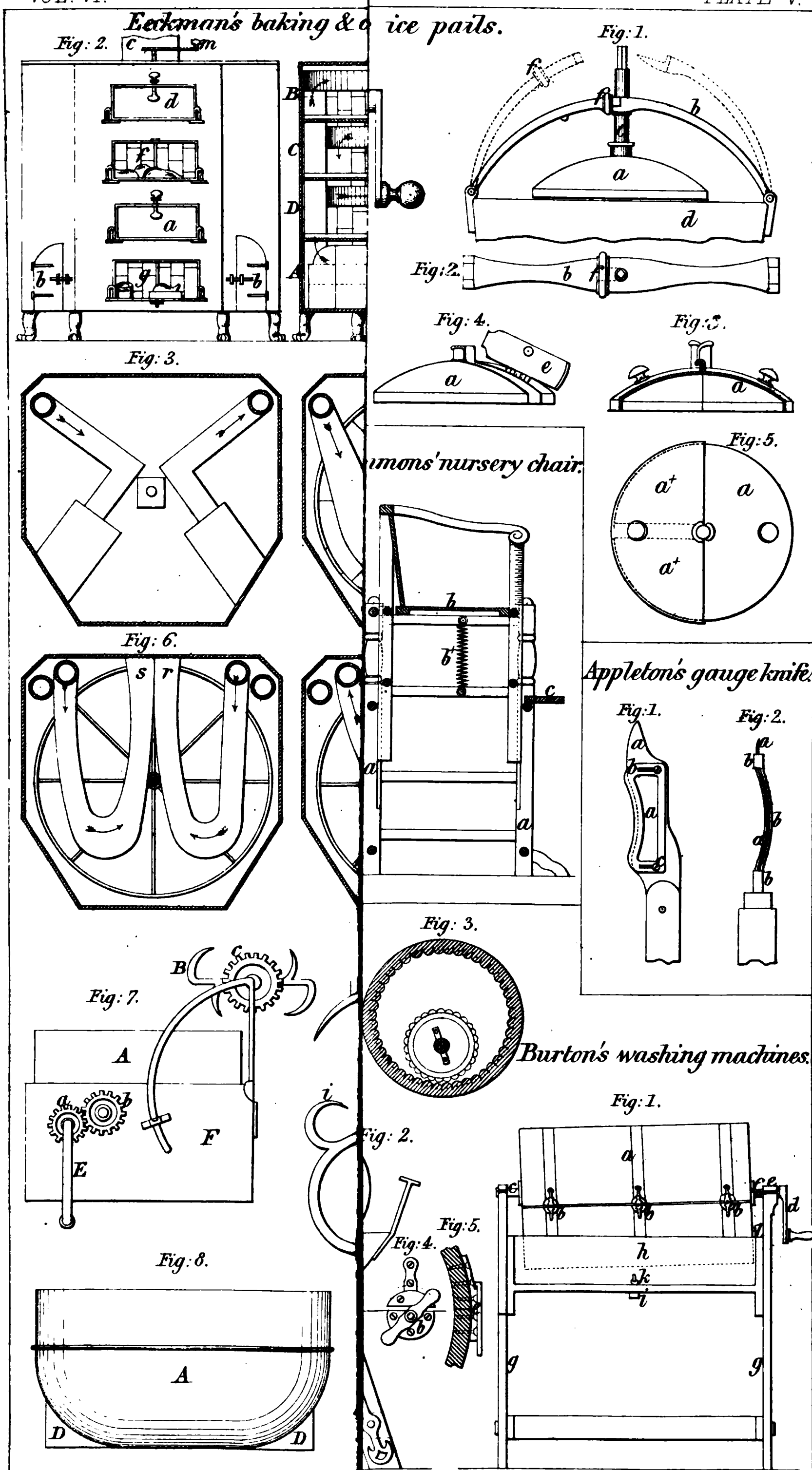


W. Newton, del.t C. Filling, lith.

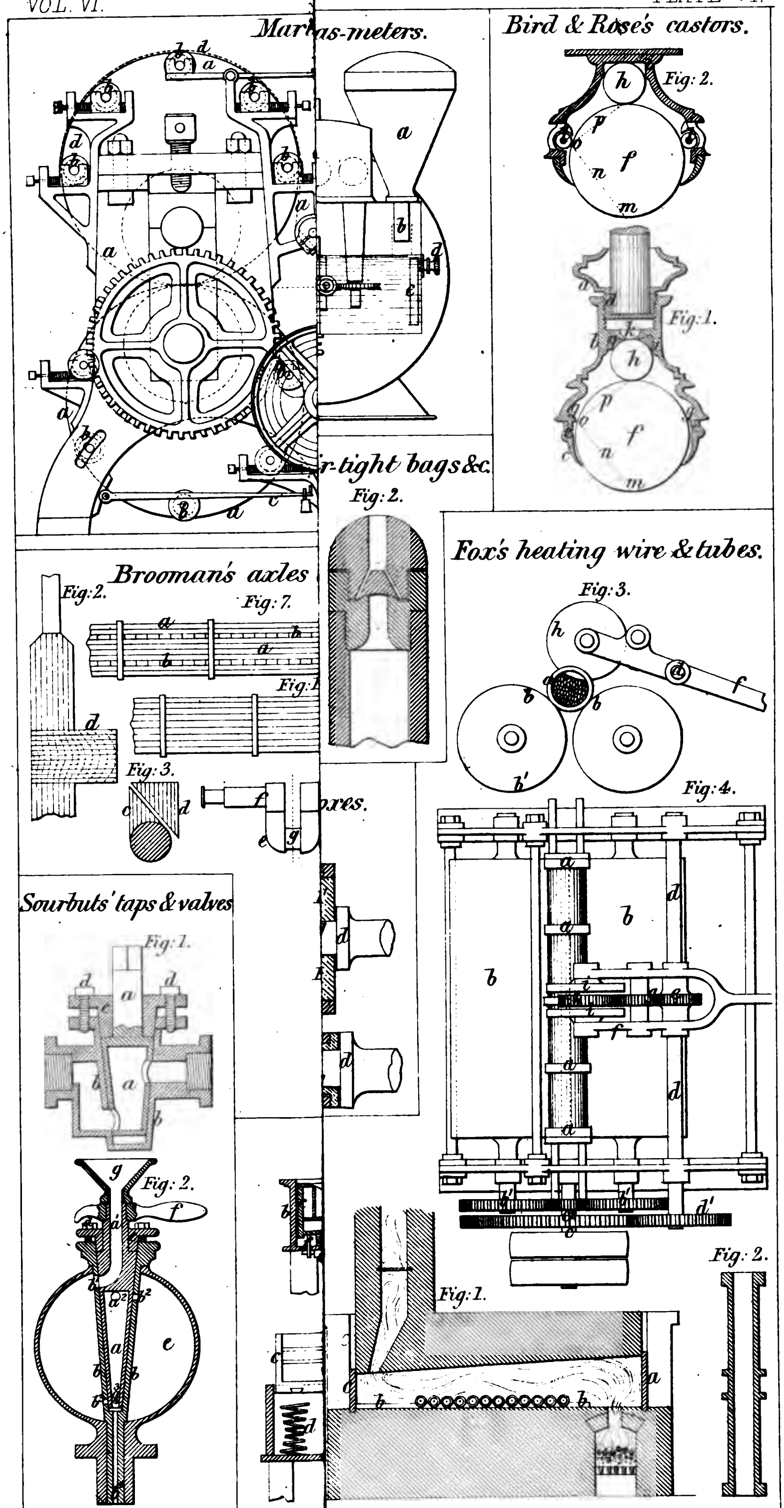


W Newton, delt.

C Pilling, lith.



W. Newton, delt. C. Pilling, lith.



W. Newton, delt. C. Pilling, lith.

Lewsey's su[...] [...]ooman's distilling appts.

Fig: 1.

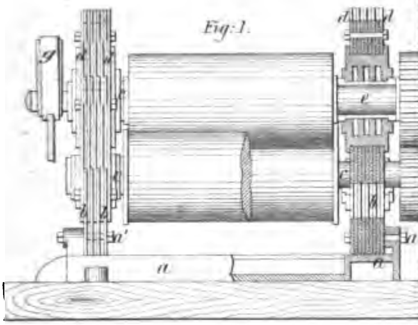


Fig: 2

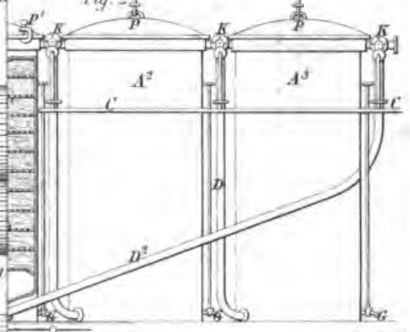


Fig: 1.

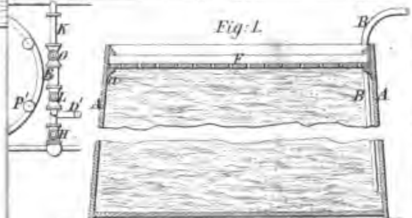
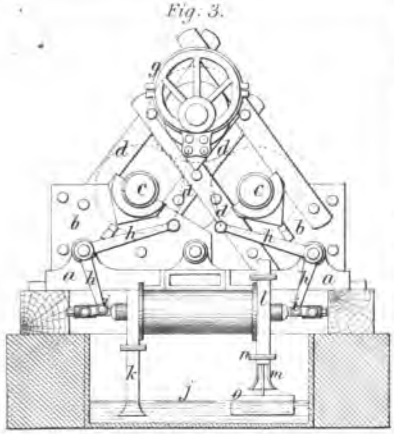
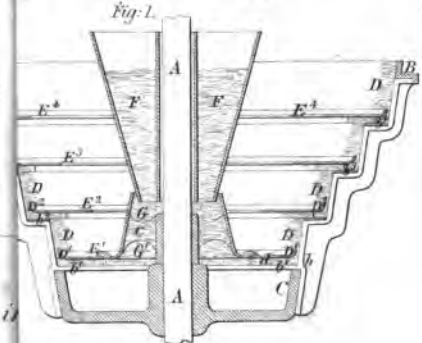


Fig: 3.



[...]spinall's curing sugar.

Fig: 1.



Aspinall's sugar refini[...]

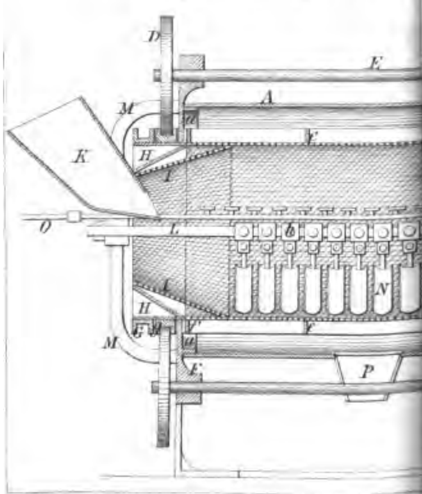
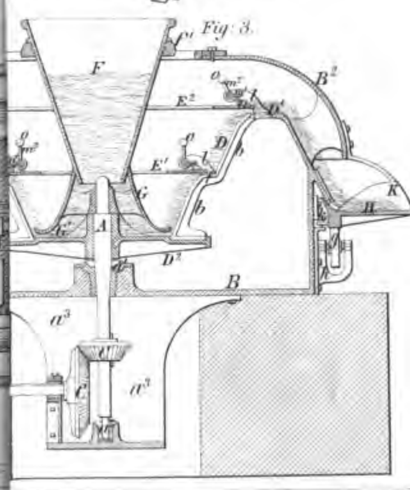
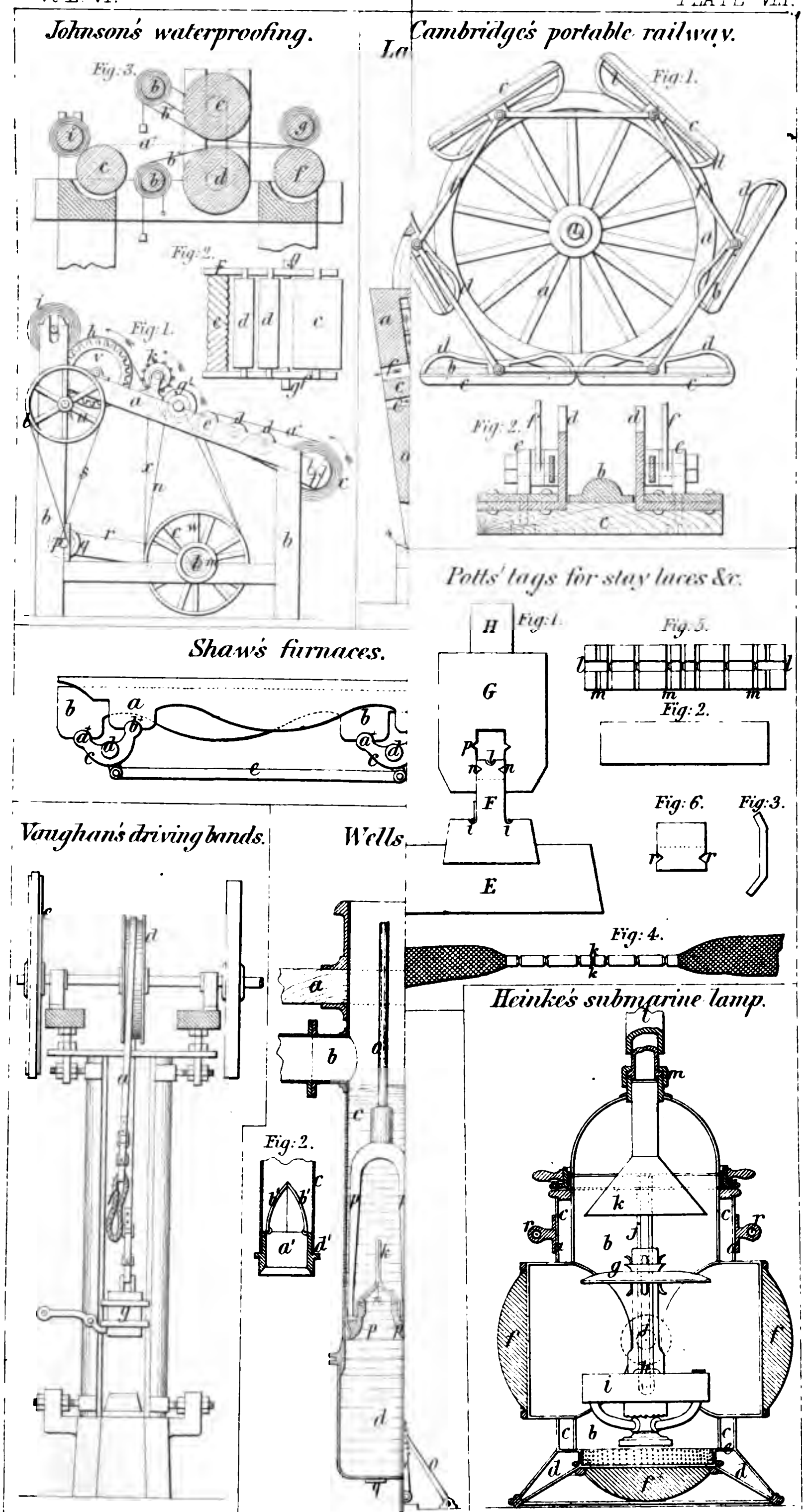


Fig: 3.

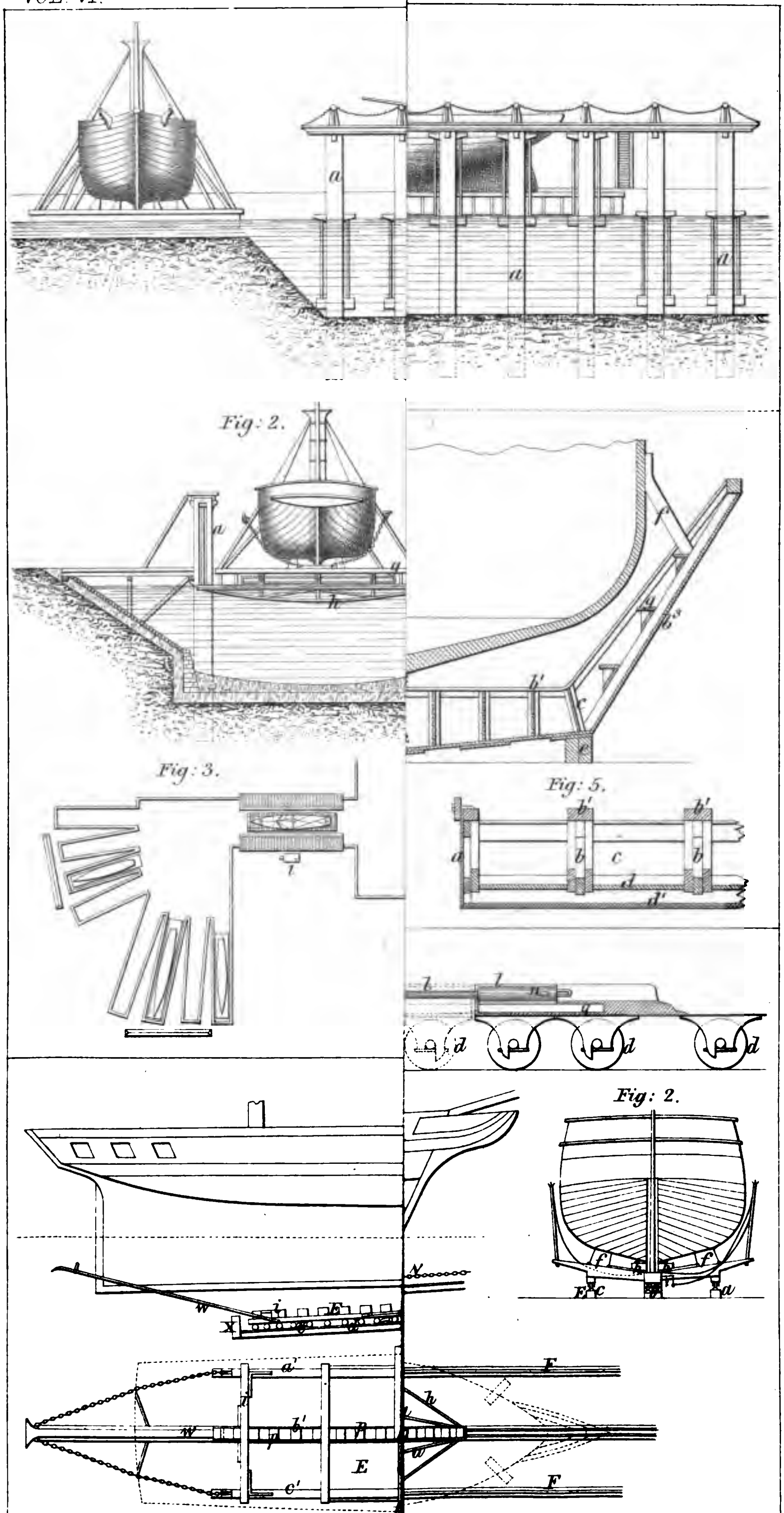


W Newton del.

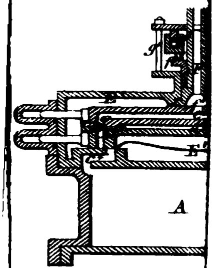
Pilling lith.

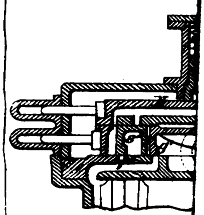


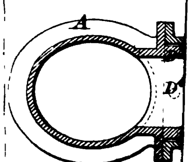
W Newton, delt. C Filling, lith.



W. Newton delt.   C. Pilling lith.

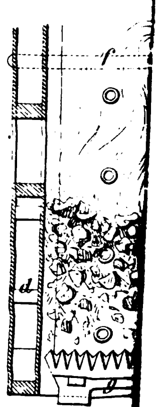






B

Chant



W. Newton, delt

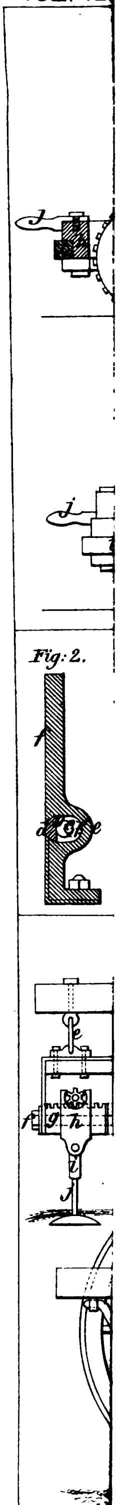


Fig: 2.

W. Newton

Haddan's smeltin

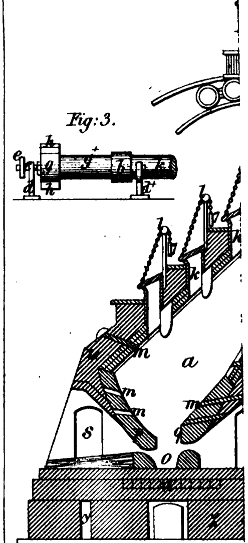
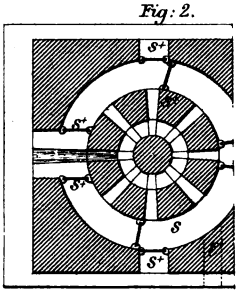
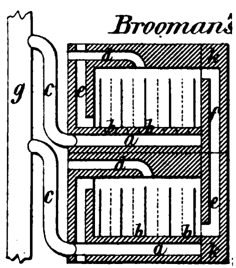


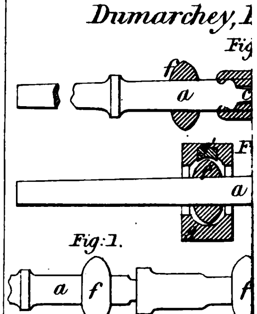
Fig: 2.



Broomans



Dumarchey, I



W. Newton, delt